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Relationships between Animal Welfare Scores and Milk Somatic Cell Count in Anatolian Buffaloes

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ABSTRACT

The objective of the present study was to determine the relationships between animal welfare score (AWS) and milk somatic cell count (SCC) in Anatolian buffaloes. The study carried out on 39 buffalo farms of Bafra district of Samsun province of Turkey between January and March 2020. To obtain AWS data, a scale with 1 to 100 points (1-25: poor, 26-50: moderate, 51-75: suitable and ≥76: excellent) was used. Locomotion ability (LA), social interaction (SI), flooring (F), indoor conditions (IC) and effect of stockman (S) were used to be AWS parameters. Milk samples were analyzed by SCC using a portable cell counter. The SCC values were transferred to log10 base before the analyses. To assess the effects of AWS on logSCC, independent sample t-test was performed. The relations of all parameters with each other were calculated by Kendall rank correlation method and the statistical analyses were carried out by SPSS 17.0. The highest and the lowest means were obtained from SI (79.66±1.28) and F (61.79±2.51), respectively. While the highest correlation was estimated between IC and AWS (r=0.724), all AWS parameters had approximately moderate relations with AWS. Positive or negative, but insignificant correlation coefficients were estimated between any traits and logSCC. The means of SCC (136841±15522 cells/ml) and AWS (68.70±1.67) of the present study were found within the suitable thresholds. Routinely keeping the records on AWS and its components, and adding AWS data to the herd management programs was suggested to the buffalo farm owners.

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Introduction

Obtaining a herd with high genetic merit and gaining sustainability are important goals of animal science. At this context, optimizing environmental conditions those exposing the animals may be seen a valuable act to attain potential production levels. In other words, breeding programs have to include both boosting genetic capacity and designing environmental factors, according to animal welfare items for livestock. Recently, interest of farm owners on animal welfare has increased because of the targets for obtaining organic products and gaining more income. Feeding, region, year, climate, indoor conditions and lactation periods may be emphasized to be major factors on animal production (Tančin et al., 2018; Leliveld et al., 2022). Especially, ensuring comfortable ambient in barns where the animals kept for a long period has a principal importance. Close relationships have been determined between indoor conditions those including floor, light, temperature, air ventilation and interest of stockman, and milk yield in dairy cattle herds (Penev et al., 2014; Angrecka and Herbut, 2015). To ensure more optimal barns, animal needs were designed as a chart, which described as Animal Needs Index (ANI) by Bartussek (2001). Reports clearly informed considerable associations between barn conditions and milk quality or quantity in cattle herds (Hristov et al., 2014; Kappes et al., 2020). Practically, ANI chart gives an opportunity for redesigning recent herd management applications to the herd owners.

Today, somatic cell count (SCC) of raw milk has been assumed one of the most reliable markers to detect milk quality (Atasever and Stadnik, 2015). Somatic cells are known as body cells and are present at normal thresholds in raw milk (Atasever et al., 2011). Accordingly, relatively higher SCC points out an abnormality in the udder gland or lower milk quality, and to prevent these cases, eliminating the environmental factors affecting SCC has been suggested by many researchers (Sant'anna and Paranhas da Costa, 2011; Erdem and Okuyucu, 2019; Atasever et al., 2020). DeVries et al. (2012) and Frössling et al. (2017) emphasized the close associations of barn conditions and management applications with SCC in

Holstein dairy cows. Also, some findings on the relations of animal welfare traits with milk production of dairy cows have been obtained (Hristov et al., 2014; Durmaz and Atasever, 2019; Islam et al., 2020). However, there is still a lack of the information on the evaluation of welfare items on buffalo farms. In other words, there is no a field study investigating the relations of animal welfare components with any milk quality parameter in buffaloes.

The aim of the study was to reveal the relationships of animal welfare score (AWS) components with SCC in Anatolian buffalo cows.

Materials and Methods

The data were consisted of SCC records and welfare assessment values of Anatolian Buffalo farms those registered to Buffalo Breeders Association (BBA) of Bafra district of Samsun province, Turkey, between January and March 2020. In farm selection, random sampling was performed. In this process, farms were selected from 205 buffalo farms those had ≥10 milking buffalo cows using a formula (Yamane, 1967). At the 90% confidence interval, a total of 46 farms was chosen, but seven farms were excluded from the list of farms to visit since they were located too far to the district center. In the examined farms, buffalo cows kept in the barns up to April were sent to pasture after that time. All buffalo cows had similar feeding and other environmental conditions during the study period. To obtain AWS data, the schedules (Bartussek, 2001; Mazurek et al., 2010) were adapted to a scale with 1 to 100 points. Durmaz and Atasever (2019) applied a similar scale for dual purpose cows in Turkey in an earlier study. Accordingly, the farms were assessed into four welfare classes (*1-25: poor, 26-50: moderate, 51-75: suitable and ≥76: excellent)*. AWS components were assessed within five parameters (Table 1) as locomotion ability (LA), social interaction (SI), flooring (F), indoor conditions (IC) and effect of stockman (S). All parameters were scored by the same person after morning milking and the means were calculated for each AWS parameter using the scale with 100 points.

The SCC data were obtained from the farm records kept during the study period. To analysis, about 50 ml raw milk samples were collected from buffalo cows belonging to registered farms on milk control days. For SCC analysis, a portable cell counter (DeLaval, Tumba, Sweden) was used. The device is an optical cell counter that gives the measuring results in less than 1 min (about 40 s/sample) and basically, cell nuclei give fluorescent signals recorded in an image that is used to determine the SCC in milk (Gonzalo et al., 2006). To fix up homogeneity and normality of variance, all SCC values were converted to log10 base. To compare the effects of AWS on logSCC, independent sample t-test was applied. While the relations of all parameters with each other were determined by Kendall rank correlation method, all statistical analyses were carried out using SPSS 17.0.

Results and Discussion

In the study, descriptive values of the investigated AWS components are shown in Table 2. As seen, there was no poor AWS class was noted among the visited farms, and the highest and the lowest means were obtained from SI and F, respectively. Accordingly, about 18 points could be noted between SI and F. In other word, SI had the highest role on the overall AWS mean, but F had the minimal effect. Actually, all markers except for SI were originated from the barn or stockman, but SI was directly obtained from animal’s behavior. According to SI data, the farms might be evaluated into excellent class. The findings on SI were also found as harmonic with a study conducted by Durmaz and Atasever (2019) on dual purpose cows in the same region. Besides, the lowest mean for F could be commented that the walking and resting area of the cows were not sufficiently clean and elastic. This case was found as parallel with the findings of some researchers (Islam et al., 2020), who noted inadequate floors and bedding to lie at small-scale dairy cattle farms in Bangladesh. Besides, due to unsuitable floor design may cause some health problems related to skin, hoof and udder and also milk yield losses (Kecici et al., 2021), showing more attention to the floor of the farms may be suggested to the farm owners. In this context, the floor with hygienic and also comfortable for walking should be favored by the farm management.

Table 1. Indicators of AWS components by classes

Parameter	Indicators
LA	Space allowance, type of stalls, outdoor access, grazing and locomotion ease
SI	Space allowance, total animal number, resting and outdoor areas, grazing facility, grouping and hierarchy
F	Type and softness of floor, cleanliness of floor and pasture
IC	Adequate light, side openings, noise, dryness of floor, grazing ability
SE	Adequate equipment, number of sick animals, cleanliness of troughs and animals, hygiene score of farm workers

Table 2. Descriptive statistics of AWS components

Trait	n	Min	Max	Median	$\overline{X} \pm S$
LA	39	44.00	100.00	68.00	68.92±1.81
SI	39	57.00	98.00	79.00	79.66±1.28
F	39	24.00	94.00	65.00	61.79±2.51
IC	39	32.50	100.00	63.75	65.25±2.50
SE	39	28.00	96.00	69.00	68.05±2.21
General	39	44.00	100.00	67.90	68.70±1.67

LA: Locomotion ability, SI: social interaction, F: flooring, IC: indoor conditions, SE: stockmanship effect

Table 3. LogSCC means by trait score groups

Trait	Score	n	logSCC ($\bar{X} \pm S$)	p value
LA	≤69p	24	5.060±0.060	0.909
	>69p	15	5.050±0.054	
SI	≤80p	25	5.046±0.064	0.371
	>80p	14	5.105±0.036	
F	≤62p	19	5.117±0.056	0.166
	>62p	20	4.998±0.061	
IC	≤65p	20	5.067±0.058	0.803
	>65p	19	5.045±0.062	
SE	≤68p	19	5.078±0.073	0.613
	>68p	20	5.035±0.045	
General		39	5.056±0.042	

LA: Locomotion ability, SI: social interaction, F: flooring, IC: indoor conditions, SE: stockmanship effect

Table 4. Kendall's tau-b correlation coefficients among the traits

Trait	SI	F	IC	SE	AWS	logSCC
LA	0.541	0.281	0.351	0.365	0.528	-0.088
SI		0.331	0.389	0.438	0.569	0.123
F			0.598	0.485	0.679	-0.227
IC				0.493	0.724	-0.134
SE					0.661	-0.153
AWS						-0.126

LA: locomotion ability, SI: social interaction, F: flooring, IC: indoor conditions, SE: stockmanship effect, AWS: animal welfare score, logSCC: log 10 based somatic cell count

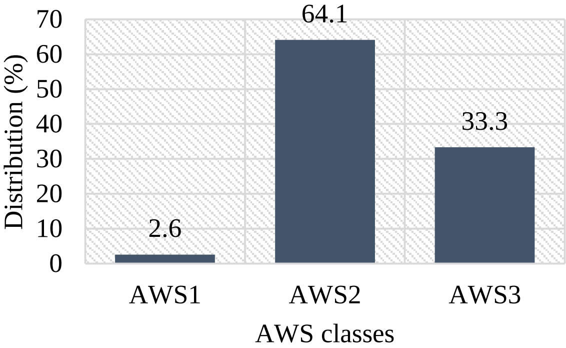

Figure 1. Distribution of AWS classes (*AWS1= 26-50p; AWS2=51-75p and AWS3=≥76p*)

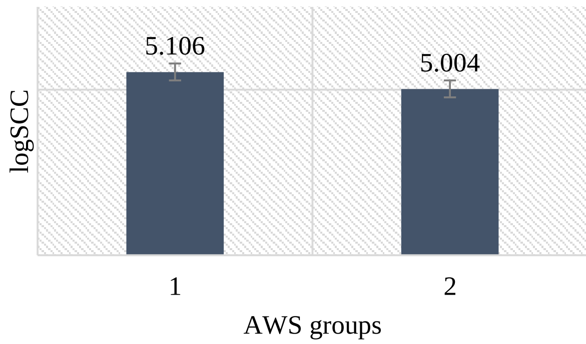

Figure 2. Change of logSCC values by AWS groups (*AWS1≤69p and AWS2>69p*)

According to the presented data, the effect of the trait scores on logSCC was statistically insignificant (Table 3). Normally, it may be expected that dairy farms with higher AWS have lower SCC or high milk quality. However, logSCC values of buffalo milk samples of the study had not a wide variation (Median: 5.136). In other words, obtained close logSCC values of Anatolian buffalo milk samples might cause to the insignificant difference between the trait subgroups in this study. Also, similar climatic and regional conditions of the farms might be caused to similar SCC of the milk of Anatolian buffaloes (DeVries et al., 2013).

The mean of untransformed SCC (136841±15522 cells/ml) was found as similar with some earlier study results conducted on Anatolian buffalo cows (Ozenc et al., 2008; Sahin et al., 2016), but found to be higher than findings of Sel et al. (2020) or lower than the results of Atasever et al. (2011). The differences of the SCC mean among the results might be caused by location or different herd management practices applied at the farms. The EU Directives (46/92 and 71/94) declared an upper limit as 400x103 cells/ml for SCC in buffalo milk that is used for human consumption (Moroni et al., 2006). Owing to elevated SCC of milk causes to dramatic losses in the milk yield (Atasever et al., 2011), keeping animals within the acceptable thresholds carries a high importance. Finally, the obtained mean of SCC in the present study could be assumed within the suitable thresholds for buffalo raw milk samples.

Kendall's tau-b correlation coefficients among the investigated traits are given in Table 4. As seen, all traits had approximately moderate relations with AWS. The findings obtained here may be assumed as similar to some study results (Furnaris et al., 2016; Durmaz and Atasever, 2019), but contrast with some others (Hristov et al., 2014; Islam et al., 2020; DeVries et al., 2013) those conducted on the cattle farms.

Accordingly, the highest correlation was estimated between IC and AWS (*r=0.724*). This case clearly points out that AWS values of the evaluated farms had substantially been affected by IC that comprising light, air quality, noise and dryness of the floor. A field study (Kecici et al., 2020) pointed out to the effects of indoor conditions on animal welfare of buffalo cows. However, the lowest correlation of AWS was calculated with LA that reflects keeping area, number of cows lying down, stall type and outdoor/pasture areas. Consequently, regarding the correlations of AWS with its components by the herd owners may be a useful approach to boost the overall AWS in buffalo farms.

In this study, some positive or negative correlation coefficients were also estimated between any traits and logSCC. Normally, SCC values of milk samples those indicate quality degrees of raw milk could be expected to decrease with higher AWS. Except for SI, all items had a negative association with logSCC, but estimated values were not significant, statistically. As mentioned earlier, a narrow variation among the SCC values in buffalo milk samples might be caused to this case.

AWS classes of the farms were determined (Figure 1). While 64.1% of the farms had suitable, 33.3% had excellent class. The overall AWS of the study (AWS=68.80p) was found within the "suitable" class. However, regarding more attention to the barn conditions by the herd owners would be ensured to reach to the excellent class of the farms.

Change of logSCC was also evaluated according to overall AWS (Figure 2). The results point out that logSCC decreased with higher AWS that reflecting the housing and well-being conditions of buffaloes. However, no statistical difference was determined between AWS1 and AWS2 groups in respect to logSCC ($P>0.05$).

Conclusion

At the end of the study, both AWS and SCC means were found within the suitable thresholds. High correlation of IC with AWS was found to be attractive. However, no statistical difference was determined by SCC according to AWS trait groups. Also, some negative or positive, but insignificant correlations were estimated between AWS traits and SCC.

Routinely keeping the records for AWS and its components and adding AWS data to the herd management programs should be suggested as beneficial approaches to boost welfare level of Anatolian buffalo cows.

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