Research Article
Volume 6:3, 2022

Journal of Animal Health and Behavioural Science

Open Access

Association of Somatic Cell Count with Milk yield and its Chemical Compositions the Egyptian Buffalo

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Abstract

The core of the present study is to investigate the effect of somatic cell count on milk yield and its gross chemical composition. The data set comprised from thirty milk record collected from thirty buffalo at the fifth month of lactation kept under field conditions among small-scale farmers in Tabanoha village, Dakahlia governorate, Egypt. The results of this research indicate that the overall means along with their standard deviations for milk yield, fat, protein, lactose, total solid and solid nonfat were 222.62± 73.64, 15.70 ± 4.98, 9.75 ± 3.33, 11.42 ± 4.18, 38.01 ± 12.08 and 22.37 ± 7.67, respectively. Somatic cell count exerted significant effect on milk yield and its various components with coefficient of determination (R^2) about 23.5%, 22.9%, 22.1%, 17.4%, 23.3% and 21.2% for the yield of milk, fat, protein, lactose, total soiled and solids non-fat, respectively. A statistically significant positive correlation was observed between milk, fat, protein, total solid and solid nonfat with milk somatic cell count (0.358*, 0.492**, 0.360*, 0.420* and 0.349*, respectively), while non-significant effect was detected between lactose and milk yield (0.303). It could be concluded that some emphasis must be placed on milk somatic cell count due to its impact on milk yield and its chemical composition.

Keywords: Milk yield • Somatic cell count • Chemical composition • Egyptian buffaloes

Introduction

Milk is an important diet of human beings. It contains a wide range of dietary components of vital importance like water, proteins, lactose, minerals and vitamins. Somatic cells in milk are predominantly white blood cells or leukocytes which are present as one of the primary protective mechanisms of the mammary gland. Somatic Cell Count (SCC) in milk is highly correlated to udder conditions but somatic cells are not the only and the most reliable proof for udder inflammation [1]. Any udder troubles are displayed in numerous changes of structure and udder functions that furthermore cause changes in milk composition. Buffaloes with mastitis have almost all milk components changed [2]. Therefore data on milk composition together with other data or without them are often used for general estimation of animal health, udder conditions and as an indicator of sub clinical mastitis, feeding errors, causes of metabolic disorders, while the breeder is informed on economy and strategy of management. The main objective of this study is to examine the changes in milk and its composition in relation to somatic cell count in the Egyptian buffalo [3].

Materials and Methods

Thirty monthly milk records at the fifth month of lactation were assembled from thirty buffalo in the same ages kept under field conditions among small-scale farmers in Tabanoha village, Dakahlia governorate. All animals calved naturally, disease-free and placed under regular feeding. Milk samples were collected twice daily [4].

Composite individual milk samples, were taken weekly from morning and evening milk (5 ml/kg of produced milk) and analyzed for fat content by the standard Gerber method (British Standard Institute), lactose was determined according to (AOAC) and protein content by the Micro Kjeldahl method (AOAC). Total Solids (TS) content was determined gravimetrically using the method of and Solid Not Fat (SNF) was calculated by the difference (T.S%-fat%) [5].

Somatic cell counts

SCC was measured by (Foss Electric A/S 69, Stangerupade DK 3400 Hilleroed, Denmark Company) in Dairy Services Unit which belongs to the (APRI), Sakha, Kafr El Sheikh Governorate [6]. Buffaloes were classified into two groups in accordance to the level of average monthly milk somatic cells count, the first one was low (<100 × 10^3/ml) and high (>100 × 10^3/ml).

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Received: 07 December, 2021, Manuscript No. AHBS-21-49208; **Editor assigned:** 09 December, 2021, PreQC No. P-49208; **Reviewed:** 23 December, 2021, QC No. Q-49208; **Revised:** 07 February, 2022, Manuscript No. R-49208; **Published:** 21 February, 2022, DOI: 10.37421/ahbs.2022.6.162.

Statistical analysis

PROC GLM procedure of the Statistical Analysis Systems (SAS) was used to analyze the Least-Squares Means (LSM) and Standard Errors (SE) for yield and some chemical composition of milk in each level of the fixed factor (somatic cells) and the differences between means were detected by Duncan`s Multiple Range Test (Duncan), also correlation coefficients and their significance were calculated throughout PROC CORR by the same program with the original data of milk somatic cell count [7].

Results and Discussion

The overall means along with their standard deviations for milk yield, fat, protein, and lactose, total solid and solid nonfat were 222.62 ± 73.64, 15.70 ± 4.98, 9.75 ± 3.33, 11.42 ± 4.18, and 38.01 ± 12.08 and 22.37 ± 7.67 kg, respectively as recorded in Table 1 [8].

Milk yield	Fat	Protein
222.62 ± 73.64	15.70 ± 4.98	9.75 ± 3.33
Lactose	Total Solid	Solid non fat
11.42 ± 4.18	38.01 ± 12.08	22.37 ± 7.67

Table 1. The means and standard deviation of milk yield (Kg) and gross chemical composition.

The results in Tables 2 and 3 clearly demonstrative that SCC in milk below and above 100*103 cells/ml had significant effect on milk yield and its gross chemical composition (P ≤ 0.01), with coefficient of determination (R^2) about 23.5%, 22.9%, 22.1%, 17.4%, 23.3% and 21.2% in the yield of milk, fat, protein, lactose, total soiled and solids non-fat, respectively, which indicate that there are other environmental factors affecting milk production and its chemical composition, for instance body condition at calving, seasonality, birth type, birth sex, administrative plans in nutrition and the availability of green forage beside animal genetic nature and genetic make-up [9]. The low level of milk somatic cells count was coupled with a decrease in milk yield and its chemical composition, vice versa. The present results were in accordance with the statements of Olechnowicz who showed that SCC in milk below and above 250 × 10^3 cells/ml had a significant effect on milk composition in dairy ewes [10] (Table 2).

Items	Milk	Fat	Protein
LL.	185.03 ± 17.51^a	13.19 ± 1.18^a	8.10 ± 0.79^a
HL.	255.50 ± 16.38^b	17.89 ± 1.11^b	11.18 ± 0.74^b
R2	23.50%	22.90%	22.10%
P-value	0.001	0.001	0.001

HL: High level; LL: Low level, ** (P<0.01)

Table 2. Means ± SE for milk, fat and protein at two levels of Somatic cell count.

Also, Chen described a possible effect of the SCC on the chemical composition of goat milk, particularly on the percentage of protein, but no significant effect was found (P>0.05), while contradictory statements were presented by Pirisi and Albenzio, they indicated non-significant differences in the percentage of fat and protein contents at high and low levels of SCC in ewe milk and both increased with the advancement of lactation, also Mazal obtained that fat and total soiled were not significantly affected by SCC in cows [11] (Table 3).

Items	Lactose	Total solid	Solids non fat
LL.	9.58 ± 1.03^a	31.87 ± 2.87^a	18.65 ± 1.85^a
HL.	13.02 ± 0.96^b	43.37 ± 2.69^b	25.62 ± 1.73^b
R^2	17.40%	23.30%	21.20%
P-value	0.05	0.001	0.001

HL: High level; LL: Low level, ** (P<0.01), * (P<0.05).

Table 3. Means ±SE for lactose, total solid and solid nonfat at two levels of Somatic cell count.

The Table 4, showed the correlations coefficients between milk yield and its chemical composition with somatic cell count [12]. It is clearly appears that there is a statistically significant positive correlation between milk, fat, protein, total solid and solid nonfat with SCC 0.358*, 0.492**, 0.360*, 0.420* and 0.349*, respectively, while non-significant coefficient was showed between somatic cell count and lactose (0.303) [13]. The present results correspond with Paura (2002) who reported positive correlation between SCC and content of fat percentage in milk (0.064**). Also, Sawa and Piwczynski reported similar findings when they determined a statistically highly significant correlation between SCC and fat content in milk from 29,000 cows [14]. For protein percentage, many authors are of the opinion that a high level of SCC is related to higher percentage of protein content in milk than a low SCC level [15-18].

Marija noticed that the milk composition was in a statistically highly significant correlation with SCC in dairy cows [19]. Bernacka found that the increase of milk somatic cell count (>601,000 cell/mL) was accompanied by an increase in the daily milk yield as well as its content of fat (P<0.01) in goats [20].

Milk somatic cell count	Milk	Fat	Protein
	0.358*	0.492**	0.360*
	Lactose	**Total solid**	**Solid non fat**
	0.303 ns	0.420*	0.349*

SCC: Somatic cell count;** (P<0.01), * (P<0.05), ns (non-significant).

Table 4. Correlations coefficients between milk yield and its chemical composition with somatic cell count.

The opposite results were showed by Delgado-Pertinez who reported negative correlations between total milk yield and somatic cells (-0.21; P ≤ 0.001) [21]. Jaeggi found that sheep milk with high SCC (>1,000,000 cells/mL) had a lower protein content than milk with low SCC (<1,000,000 cells/mL) [22]. Carolina Barbosa showed that Somatic cell count is negatively associated with reduced the percentage of lactose and solids nonfat content in milk in Gyr cows [23].

Conclusion

Tabular results in the present study allow us to highlight a direct link between the SCC and the composition of buffalo's milk. SCC exerted significant effect on milk yield and its various components, so the causes of the increase milk somatic cell count should be taken in mind in order to get higher milk yield.

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How to cite this article: Ali El-Raghi, El-Moghazy MM. "Association of Somatic Cell Count with Milk yield and its Chemical Compositions the Egyptian Buffalo." *J Anim Health Behav Sci* 6 (2022): 162.