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EFFECT OF AGE ON SOMATIC CELL COUNT AND MILK COMPOSITION IN SHEEP MILK

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ABSTRACT

A total of 50 sheep milk samples during lactations were used to investigate the impact of subclinical mastitis induced Somatic Cell Count (SCC) increase on changes in chemical composition in milk. Samples were collected and analyzed for fat, protein, lactose, solids non-fat (SNF) and total solids (TS) and SCC. Within three stages of lactation, all milk samples were analyzed for three times. The highest average of SCC was recorded in ewes aged 4 years (46.67) while lowest average was recorded at the age of 3-3.5 years (34.24%). Protein content was highest at ewes aged 1-1.5, whereas highest lactose percentage recorded at ewes aged 3-3.5. In conclusion, in high SCC milk, lactose content may be more indicative of SCC level than milk fat, protein, SNF and TS during lactation. Age of ewes is an important factor affecting milk composition, thus is a necessary parameter in optimizing sheep milk quality in conditions of subclinical mastitis.

***KEYWORDS**:* Sheep; Subclinical mastitis; Somatic cell count; Milk

1. INTRODUCTION

Mastitis is an inflammation of the mammary gland caused most commonly by mastitis-causing organisms and rarely physical or chemical trauma, characterised by pathological changes in the mammary tissue; an increase in the number of somatic cells, physical, chemical and microbiological changes in the milk. In the dairy cattle population, both clinical and sub-clinical mastitis can affect the composition and manufacturing properties of milk Auldist, M.J *et al* 1998 and Pyorala, S *et al* 2003.

The frequency of clinical and subclinical IMI in modern dairy cow herds is estimated to exceed 30-50%, which results in decreased milk yield and consequent deterioration of the quality of milk and dairy products. It is thought that altered milk composition during mastitis leads to the change of physico-chemical properties in milk. It is generally known that 70-80% of the estimated $140-300 loss per cow/year from mastitis relates to reduced milk production and decreased cheese yield caused by subclinical mastitis (Ravinderpal *et al.* 1990).

Sheep with subclinical mastitis have reduced milk and cheese yields because of deterioration of milk quality in the infected glands (Leitner *et al.* 2004). This effect in dairy sheep could be more detrimental because of the common practice of seasonal lactation among most dairy sheep herds and the fact that sheep milk has naturally higher SCC than cow milk, (D’Amico and Donnelly 2010). More research is needed to identify effective measures in minimizing the occurrence of subclinical mastitis and in improving production and quality of sheep milk and cheese.

Milk yield and composition are the main selection goals for dairy sheep (Milerski *et al.* 2006). Milk composition is as important as the milk yield in sheep breeding. The amount and quality of milk is influenced by genetics, environment, management and animal health. The term milk quality refers to the suitability of milk for drinking or for processing into milk products and the health status of the animal producing this milk (Leitner *et al.* 2016).

The somatic cell count (SCC) in milk is the terms of physiological and pathological traits (Fragkou *et al.* 2014). Since somatic cells are one of the major defense components of the mammary gland against infections, it is an indicator of udder health (Li *et al.* 2014). The normal range of SCC in bacteria free udders of sheep (300.000 cells/ml) and sheep (200.000 cells/ml) is generally higher than in dairy cows (70.000 cells/ml) (Silanikove *et al.* 2010). Milk yield and milk composition parameters in dairy

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sheep show an impairment starting from 300.000 cells/ml. Therefore, SCCs that increase from 300.000 cells/ml to 1.000.000 cells/ml indicate that such secretion can be considered as transition milk from normal milk to mastitis milk (Olechnowicz and Jaskowski 2014).

The main objectives of this study were to determine:

1. Milk composition (fat, protein, lactose, solid nonfat and total solid), and SCC.

2. The relationships between these characteristics in sheep.

2. MATERIALS AND METHODS

Animals

Milk was obtained from individual doe udders of lactating Sheep ewes in local farms (n= 50) during lactation stages (November and December 2019). Milk samples from each udder were subjected to three consecutive every two week examinations for SCC test at the University of Dohuk Lab.

Milk

Prior to milk collection, teats were carefully cleaned with iodine. The first three streams of foremilk were discarded and the milk afterwards was collected from each gland into sterile vials and separated into two parts: one analyzed for chemical composition (fat, protein, lactose, SNF, TS) and SCC at the University of Duhok Lab at the same day.

Milk was recorded fortnightly after parturition for three times. Ewes milked by hand. Composition (fat, solid non-fat, protein, lactose) of milk samples taken from ewes was determined by Eko-milk machine

Somatic Cell

Milk samples were collected on the same test-day and somatic cell counts were measured by the direct microscopic method as described by (Coles 1986).

Statistical analysis

In this study, the effects of ewes age and on milk yield, milk composition and SSC were investigated. The data were analyzed by least squares means using the general linear models in (SAS 2005). Duncan's multiple-range test was used to compare differences between the means of` the sub-groups. Pearson correlation coefficient analysis was used to measure of linear association among the traits.

The statistical analysis was based on the general linear model:

$$Y_{ij} = \mu + a_i + e_{ij}$$

Where: Y_{ij} = Observation value of the measured or assessed trait

μ = The overall mean

a_i = The effect of age of ewes (i = 1-1.5, 2-2.5, 3-3.5, 4)

e_{ij} = The random error

3. RESULTS

Least-squares means and standard errors for somatic cell count (SCC) according to the control times are shown in (Table 1). The mean (SCC) for I. control, II. control, III. control and average of controls were 40.20±3.03, 39.44±2.65 and 37.96±2.31 respectively. It was seen that 3-3.5 aged ewes had the highest and 4 aged ewes had the lowest milk yield in all the control times. These differences were found statistically significant (P<0.05).

Table (1): Least-squares means and standard errors for somatic cell count (SCC) according to the control times in Iraqi sheep.

Factors	n	SCC ($x10^3$ cells/ml)			
		I. Control	Control	III. Control	Average of controls
		$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$
General	50	40.20±3.03	39.44±2.65	37.96±2.31	39.20±2.44
Age					
1-1.5	9	47.22±8.93	47.56±8.54	37.78±7.04	44.19±7.64
2-2.5	15	41.80±7.05	41.33±5.53	38.87±4.92	40.67±5.60
3-3.5	21	34.14±2.18	33.71±2.69	34.86±1.91	34.24±1.57
4	5	48.20±11.85	43.20±7.44	48.60±10.40	46.67±9.42

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Table (2): Least-squares means and standard errors for milk composition traits in Iraqi sheep

Factors	N	Fat (%)	Solid not-fat (%)	Protein (%)	Lactose (%)
		$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$	$\bar{x} \pm S_{\bar{x}}$
General	50	6.72±0.19	9.50±0.06	4.53±0.06	4.33±0.02
Age				*	*
1-1.5	9	6.78±0.31	9.73±0.16	4.80±0.17a	4.37±0.03ab
2-2.5	15	7.02±0.41	9.38±0.14	4.42±0.11b	4.26±0.04a
3-3.5	21	6.54±0.29	9.43±0.07	4.47±0.08ab	4.39±0.05b
4	5	6.42±0.70	9.68±0.28	4.55±0.20ab	4.26±0.08ab

*: P<0.05

a, b: Means values with different letters are significant (P<0.05).

(Table 2) shows least-squares means and standard errors for milk composition traits. The mean fat, solid non-fat, protein and lactose percentages were 6.72%, 9.50%, 4.53% and 4.33%, respectively. There was no significant effect on the fat and solid non-fat percentages of the age of ewes (P>0.05).

Milk samples taken from ewes aged 1-1.5 years had a higher protein content (4.80%) than those ewes aged 2-2.5 years (4.42%) (P<0.05). Similarly, milk samples of ewes aged 3-3.5 years had higher lactose content (4.39%) than those ewes aged 2-2.5 years (4.26%) (P<0.05).

Milk composition of ewes with 1st udder type was 6.46% fat, 9.52% solid non-fat, 4.60% protein and 4.36% lactose, respectively. Similarly, fat, solid non-fat, protein and lactose content in milk of ewes with 3rd udder type was 6.95%, 9.47%, 4.46% and 4.31%, respectively. Udder types did not have a significant effect on the milk composition.

Table (3): Correlation coefficients among milk composition traits and somatic cell count.

	Solid non-fat	Protein	Lactose	SCC
Fat	-0.06741	0.11903	0.06145	-0.26493
Solid non-fat		0.63730***	0.27650*	0.06020
Protein			0.35088**	-0.11813
Lactose				-0.29025*

CSS: Somatic Cell Count

*: P<0.05, **: P<0.01, ***: P<0.001

On the other hand, solid non-fat had positive (0.63730) and highly important (P<0.001) correlation with protein. The relationship between solid non-fat and lactose was also significantly important (P<0.05). However, a negative relationship was determined between solid non-fat and test day milk yield (-0.15915).

The content of protein was correlated with lactose (P<0.01). The correlation coefficient between protein and lactose was found as r= 0.35088. Protein content of milk had weak correlations with TDMY and SCC. However, lactose content of milk had a negative and significant correlation with SCC (r= -0.29025, P<0.05).

3. DISCUSSION AND CONCLUSION

The SCC values observed in this study were higher than SCC value (4.09 x10^3 cells/ml) reported for Manchega sheep by (Arias *et al.* 2012). However, SCC values in Iraqi ewes were lower than SCC values of 108.8, 102.5, and 155.9 x10^3 cells/ml reported for Sardi ewes in early, middle, and late lactation stage (Bonelli *et al.* 2013). Contrary to study findings, Arias et al. (2012) found highly significant effect of doe age on SCS, increasing with the age.

(Vrskova *et al.* 2015) determined that 76% of purebred Tsigai ewes were below SCC 300 x10^3 cells/ml. The threshold SCC values for healthy, sub-clinical and clinical mastitis in Iraqi ewes were reported ≤175.000, >175.000 to ≤1.150.000 and >1.150.000 cells/ml of milk, respectively (Al-Zubaidy and Salari 2016). For different purebred and crossbred sheep of Slovakia, (Tancin *et al.* 2017) reported that 82.03% of examined milk samples were below 400 x10^3 cells/ml and only 8.89% over 1.000 x10^3 cells/ml.

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In the study, the mean fat, solid non-fat, protein and lactose percentages were 6.72%, 9.50%, 4.53% and 4.33%, respectively (Table 3). No significant effect of doe age on fat and solid non-fat contents was determined. Iraqi sheep had higher milk fat content and lower solid non-fat, protein, and lactose content compared to the values reported by (Alexopoulos *et al.* 2011), (Abdullah *et al.* 2011) and (Tancin *et al.* 2017) for various sheep breeds.

However, doe age had statistically significant effect on protein and lactose ($P<0.05$). The protein content of milk obtained from 1-1.5 aged ewes was higher than that obtained from 2-2.5 aged ewes. As for lactose content, ewes aged 3-3.5 had higher milk lactose than those ewes aged 2-2.5. Contrary to study findings (Abdullah *et al.* 2011) reported the significant effect of doe age on fat content ($P<0.05$), but no significant differences in percentages of solid non-fat and protein.

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