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THE ACCURACY OF A4 AND AC METHODS FOR DETERMINING LACTATION IN CONTROL DAY IN THREEFOLD MILKING OF AWASSI BREED OF SHEEP

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Abstract

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The most important thing for successful selection in dairy sheep breeds is precise milk control, using methods that simplify the procedure and are inexpensive. The purpose of this research is to compare the A4 (as a reference method) and AC (as an alternative method) for determining the milk yield in the recording day in Awassi breed of sheep in the period from 2005 to 2008, with threefold milking (morning, afternoon, evening). It is determined that the difference between the predictions of daily milk yield after one of three milking (morning, afternoon, evening) and the measured milk yield according the A4 method, depends on environmental and age factors. Providing all the analyzed factors (year/month control, age/lactation and number of newborn lambs) the most important is the fourth factor (type of dynamics of daily milk yield) which shows that after threefold milking it is recommended to make the recording in afternoon milking, using the AC method.

Key words: Awassi sheep; daily milk yield recording; A4 method; AC method; prediction; comparison

Introduction

The most used methods for evaluating the milk yield on the recording day are A4 and AC methods, and by means of these methods the milk yield is determined during 5 and 6 weeks (ICAR, 2012). The A4 method is accepted as reference method with twofold individual measurement of milk yield (morning and evening), (Pacinovski and Eftimova, 2004). The most used official absolving of that method is single individual measurement of the milk yield in one of the milking (morning and evening) and using the correction coefficient with total milked milk in the flock, on the control day i.e. so-called AC method.

The assays regarding the alignment of the two methods show that the milk yield during the milking period (TMM-Total milking milk) is reducing by 2-3% in the first half of the period and it is increasing by the same percentage in the second half at abridged AC method in alignment with A4 method. The correlation between the two methods is very high, more than 0.98 and the maximal variation in predicting the average TMM of 200 liters is from -46.4 L to +55.1 L. The both methods are accepted as well enough accurate (ICAR, 2012).

The assays at the Institute for Animal Science in Kostinbrod, R. Bulgaria, show that TMM is slightly decreasing with AC method for 120 days (Ivanova, 2014). Our data obtained from limited number of sheep from Awassi breed in R. Macedonia show that the correlation between the two methods is high, with maximal variations in prediction from 1.9 to 3.4 L, (Gievski et al., 2006).

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The interest for using the abridged methods for milk yield control is determined by the complexity of the A4 procedure. Such methods are represented in all countries (Table 1) that have developed dairy sheep breeding (ICAR, 2012).

Table 1
Methods for milk recording of sheep in some countries in Europe

Country	A4	AT	AC
Greece	100%		
Portugal	100%		
Spain		100%	
Slovenia		100%	
Croatia		100%	
Italy		%	
Slovakia			100%
France			100%

The aim of this research is to determine the prediction accuracy of the daily milk yield in sheep with one measurement, on the control day with threefold milking.

Material and Methods

The experiment included 540 milk yield controls from 76 Awassi breed of sheep, measured three times: morning, noon and evening. Only data from threefold measurement are used, which are mostly on the beginning of the milking period. The individual measurements, in which in one of measurements during the control day end data for milk yield, are not included in the analysis.

The average factors are forming from the 17th year/control month, 11 ages, 2 groups for number of newborn lambs in the period of 4 years i.e. from 2005 to 2008.

The milk yield was measured on the recording (control) day (TDA – Total daily), by the total milk from individual controls: morning (TDM – Total daily morning), afternoon (TDN – Total daily afternoon) and evening (TDE- Total daily evening).

To determine the individual milked milk: morning, afternoon and evening, a calculation of appropriate amount of total milk is performed for the appropriate control day with total measured milk for a given period of the day. For that purpose 17x3 coefficients are formed. The difference between the predicted individual and actual daily milk yield is determined.

DM = TDM-TDA
DN = TDN-TDA
DE = TDE-TDA

The three differences are analyzed for the influence of the year/control in order, age, the number of newborn lambs and the type of dynamics of daily milk yield. The last factor, type of dynamics of daily milk yield is determined by appropriateness and variations of the average values of individual measured milk yield in separate periods of the day (Table 2). Sheep with maximal milk yield in the morning are marked with type 1, sheep with maximal milk yield measured in the afternoon during the day are marked with type 2 and sheep with maximal milk yield measured in the evening are marked with type 3. This division is made in order to characterize more precisely the difference in predicting the daily milk yield.

Table 2
Average milk yield for the day of test, measured during morning, noon and evening milking, L

Parameters	Morning	Noon	Evening	Total
Average, L	0.85585	0.57891	0.5683	2.00306
SD, L	0.30401	0.24136	0.2359	0.69674
Minimum, L	0.2	0.1	0.15	0.5
Maximum, L	1.82	1.5	1.4	4.5
Diference max – minimum, L	1.62	1.4	1.25	4
Diference in Sd	5.32875	5.80048	5.298	5.74103
Cv, %	36	42	42	35

For analyzing the three differences, the following model is used:

$$Yijklm = \mu + MYi + Lj + NLk + Tl + eijklm,$$

where:

Y – is the difference between predicted and actual measured milk yield,

MY (DM, DN, DE) – month and year of measurement (i = 1,….,17),

L – lactation in order (j = 1,…..,11),

NL – number of newborn lambs (k = 1, 2),

T – type of dynamics of daily milk yield (l = 1,…..,3)

eijklm – is residual influence

Results and Discussion

The average difference between the predicted and actual measured milk yield is given in Table 3. In predicting the total daily milk yield by morning milking, the actual milk yield is reduced by 0.214 L, and using the data from the noon and evening milking measurement, it is increased by 0.135 L or 0.150 L, appropriately. These differences are within 7-10% from average measured daily milk yield of 2.0 L (Table 2),

which can be taken as good accuracy for prediction, with using simple method for control. The difference between the minimal and maximal error in the morning measurement is 6.30 Sd, in afternoon milking is 6.67 Sd and in evening milking is 7.42 Sd, between the predicted and actual measured milk yield at appropriate Sd from 0.23 L, 0.29 L and 0.33 L.

Table 3
Average differences between test day milk yield, L, predicted on the morning, noon and evening measurement and actual yield

Difference predicted – actual daily milk yield	Mean	SE	95% Confidence Interval	
			Lower Bound	Upper Bound
Morning, DM	-0.214	0.026	-0.266	-0.162
Noon, DN	0.135	0.036	0.064	0.206
Evening, DE	0.15	0.04	0.071	0.228

In order to minimize the error of predicting the daily milk yield, the influence on variations of certain factors is analyzed in predicting the morning, afternoon and evening milking (Table 4). The year/control month (P<0.05*), the lactation (P<0.05*) and the type of dynamics of daily milk yield (P<0.001***), have significant influence on the difference in the morning milking, while the number of newborn lambs has no significant influence (P>0.05*).

The conditions (year/control month) and age have no significant influence on variation in afternoon milking, while there is significant influence determined from the number of newborn lambs (P<0.05*) and from the type of daily milk yield (P<0.001***). In predicting the daily milk yield by the milk yield from evening milking, the factor year-measure month has no significant influence on the difference, while the lactation (P<0.05*), the number of newborn lambs and the type of daily milk yield (P<0.001***) have significant influence.

The average variations of daily milk yield prediction for separate years and months (Table 5) are insignificant (negative) in morning measurements and range from -0.035 to -0.290 L. The prevision according to the milk yield in afternoon milking increases (overrates) the actual milk yield in variations from +0.041 to +0.189 L. In the evening measurement, in only one year/season, the actual milk yield decreased (underrated) by -0.166 L, while in other groups increased (overrated) with maximal value of 0.227 L. Such dynamics in the separate levels of average factor can be defined as unidirectional and with equal significance.

Table 5
Effect of year-month of measurement on the difference between predicted and actual milk yield, L

Year / month	N	Morning, DM		Noon, DN		Evening, DE	
		Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
200201	10	-0.257	0.07	0.13	0.096	0.202	0.106
200202	23	-0.246	0.05	0.15	0.069	0.16	0.076
200203	26	-0.246	0.048	0.156	0.066	0.155	0.073
200204	28	-0.251	0.047	0.153	0.065	0.168	0.071
200205	31	-0.25	0.045	0.156	0.063	0.162	0.069
200206	32	-0.249	0.045	0.154	0.062	0.163	0.068
200207	33	-0.249	0.045	0.154	0.061	0.164	0.068
200208	11	-0.035	0.066	0.189	0.091	-0.166	0.101
200303	21	-0.162	0.052	0.12	0.072	0.11	0.079
200304	27	-0.153	0.047	0.094	0.065	0.125	0.071
200403	22	-0.208	0.052	0.129	0.072	0.16	0.079
200404	31	-0.153	0.045	0.041	0.062	0.174	0.068
200405	33	-0.16	0.044	0.079	0.061	0.146	0.067
200406	38	-0.197	0.044	0.114	0.06	0.16	0.066
200504	55	-0.248	0.038	0.135	0.052	0.211	0.058
200505	59	-0.284	0.038	0.166	0.053	0.227	0.058
200506	60	-0.29	0.038	0.177	0.053	0.224	0.058

The average variations of prediction in individual ages (Table 6), in most of the cases are insignificant (negative) in morning milk and range from +0.043 to -0.312 L. The milk yield prediction in the afternoon milking, with the exception of the 6 measurements of 10th lactation, increases (overestimation) the actual daily milk yield with variations from -0.032 to + 0.424 L. In evening measurement of only

Table 4
Factor influence on the difference predicted – actual milk yield

Trait		Morning, DM		Noon, DN		Evening, DE	
Source	df	F	Sig.	F	Sig.	F	Sig.
Year-month	16	1.807	0.028	0.423	0.977	0.975	0.483
Lactation	10	2.197	0.017	1.64	0.092	2.308	0.012
Number of lambs born	1	3.426	0.065	5.036	0.025	25.839	0
Type of daily milk yield	2	80.501	0	27.799	0	37.822	0
R2		0.258		0.132		0.134	

one of the ages (in 11th lactation), the actual milk yield is decreased (underestimation) by -0.195 L, while in other ages it increases (overestimation) by maximal value of 0.247 L. Such dynamics in separate group ages can be defined as unidirectional and with equal significance, despite the significant influence on the lactation factor in morning and evening milking.

Table 6
Effect of lactation on the difference between predicted and actual milk yield, L

Lactation	N	Morning, DM		Noon, DN		Evening, DE	
		Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
1	101	-0.255	0.031	0.128	0.043	0.215	0.048
2	102	-0.266	0.032	0.125	0.044	0.252	0.049
3	73	-0.238	0.035	0.065	0.048	0.263	0.053
4	98	-0.312	0.032	0.17	0.044	0.274	0.048
5	52	-0.266	0.038	0.109	0.052	0.246	0.058
6	39	-0.239	0.04	0.156	0.055	0.167	0.06
7	42	-0.156	0.038	0.085	0.053	0.048	0.058
8	18	-0.245	0.053	0.203	0.074	0.143	0.081
9	7	-0.308	0.083	0.424	0.114	0.055	0.126
10	6	-0.112	0.087	-0.032	0.119	0.179	0.132
11	2	0.043	0.147	0.054	0.202	-0.195	0.223

The average variations of prediction in sheep that gave birth to one or two lambs (Table 7), are insignificant (negative) in morning measurement where the underestimation in sheep that gave a birth to one lamb is -0.187 L, and in sheep that gave birth to two lambs is with -0.241 L, i.e. actual daily milk yield is underestimate significantly (more sensible) in sheep with two lambs.

Table 7
Effect of number of lambs born on the difference between predicted and actual milk yield, L

No of lambs born	N	Morning, DM		Noon, DN		Evening, DE	
		Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
1	450	-0.187	0.027	0.18	0.037	0.039	0.04
2	90	-0.241	0.033	0.091	0.045	0.261	0.05

The milk yield prevision in afternoon milking overestimate the actual daily milk yield in variation from +0.091 in sheep with two lambs to +0.180 L in sheep that gave birth to one lamb. In evening measurement, the actual milk yield is overestimate again as in afternoon milking, where the overestimation is greater in sheep that bear twins with +0.039 L. Such dynamics of variations in certain period of the day shows that the sheep that bear twins are underestimating more in the morning and afternoon control and are overestimate in the evening control in comparison with the sheep that gave birth to one lamb. Similar results about the influence of lactation on daily milk production at Awassi and East-Friesian sheep in Macedonia obtained Dimov et al. (2005), Dzabirski et al. (2006), Pacinovski (2011), Pacinovski et al. (2014), Pacinovski et al. (2016).

The average variation in predicting the milk yield in sheep from the first type of dynamics of daily milk yield i.e. in sheep where maximal daily milk yield is measured in morning milking (Table 8), is satisfyingly (positive), where the overestimation is by 0.076 L, while in the second and third type of dynamics of milk yield, the predicted milk yield sequentially underestimate the actual milk yield by +0.369 L and +0.349 L, i.e. the actual milk yield is significantly underestimate in sheep with variations from the total daily milk yield dynamics.

The milk yield prevision in afternoon milking overestimate the actual milk yield with variations from +0.489 L in type 2 and slightly underestimate, with -0.052 L, in sheep from type 3. In evening measurement, the actual milk yield is slightly underestimate in type 1 and 2, with -0.049 L and -0.006 L., appropriately.

The results show that irrespective of the factors of environment, age and number of newborn lambs, in morning measurement, the daily milk yield slightly underestimate. However, the influence is not always unidirectional in afternoon and evening milking. In some cases the actual milk yield is overestimate and in other underestimate. A compromise is necessary. The fourth factor is more important: type of dynamics of milk yield. It shows that for most sheep which follow the normal dynamics of daily milk yield (type 1), the error is minimal, under 0.1 L., while for the rest the error is multidirectional (Table 8). To keep in view that the correlative number of the controls is small, the type 2 and 3 represent 3.3% and 5.5% and accumulates such error. For the other, over 90%, the error is significantly lower, whether the control is in the morning, afternoon or evening.

Table 8
Effect of type of daily milk yield on the difference between predicted and actual milk yield, L

Type of daily milk yield	N	Morning, DM		Noon, DN		Evening, DE	
		Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
1	492	0.076	0.021	-0.041	0.029	-0.049	0.032
2	18	-0.369	0.051	0.498	0.070	-0.006	0.078
3	30	-0.349	0.044	-0.052	0.060	0.504	0.066

At midday control the overestimate is in type 2 with 3.3% of the measurements, while in other is minimal. Such data show that in threefold milking is recommended to make the control measuring at noon using the AC method. Similar results about the AC method at East-Friesian sheep in Macedonia obtained Pacinovski et al. (2015).

The analyzing of the differences in daily milk yield dynamics presents certain selective interest. This also shows the significance of A4 method for milk yield control. We hope that in a short period of time we will have enough data and information collected for this question to be discussed in more detail.

Conclusions

Based on this research it can be concludes:

- The difference between the daily milk yield prevision at one of the three milking (morning, noon, evening) and measured milk yield according the A4 method, depends on environment and age factors;
- In morning milking control, the method AC underestimate the milk yield by around 10%, determined by A4 method;
- As generall conclusion the milking at noon predicts with smallest deviation the actual A4 milk yield.
- The results of these analyses go in the direction of finding most suitable milk yield control methods, which would significantly influence on expenses decrease in collecting data for milk yield dairy sheep, which are exceptionally important for successful and meaningful selection.

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