

STUDY REGARDING THE INFLUENCE OF THE AGE OF FIRST CALVING, PARITY, NEW-BORN WEIGHT AND CALVING SEASON ON DAILY GAIN OF CALVES GROWTH IN A FARM IN NORTH-EAST OF ROMANIA

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Abstract

The aim of the present study was to highlight the influence of the age of first calving, parity, new-born weight and calving season on the average daily gain. The biological material consists of Holstein calves reared in an intensive system. The data obtained from the measurements at 7 days and 30 days, were statistically processed with the help of Statistics Analysis of Variance and Covariance (SAVC) and SPSS 16.00 computer programs. Significant differences between batches ($p < 0.05$) were observed at 7 days, between calves born by cows having second parity which has a mean with 0.300 g higher of daily gain than those calved by third parity cows. At 30 days, the daily gain mean value has significantly greater differences ($p < 0.05$), been with 0.12 g/day higher in the case of calves born in winter compared to those born in summer and with 0.14 g/day compared to those calved in spring ($p < 0.01$). In the case of calves studied for age at first calving and birth weight, there are no differences between the batches so, these factors not influencing their further development in the case of the considered periods.

Key words: age at first calving (AFC), daily gain, Holstein, parity.

INTRODUCTION

For the calves, the suckling period is a critical one in terms of the future performance and the evaluation of the body development of the animals is done by monitoring the daily weight gain (DWG). Studies show an association between body weight achieved at 30 days and a reduced age at first calving (Brickell, 2009; Raducanu et al., 2023) and that DWG influence the productive performance in first lactation. Thus, daily weight gain of more than 500 g/day during this period has a positive impact on production in first lactation and some studies has suggest that each 100 g of DWG can be associated with an extra 85-110 kg of milk. (Hyde M.R. et al., 2021).

The evolution of calf weight gain is influenced by a number of different factors such as genetic (breed) or non-genetic ones (age at first calving of the female, parity, calving and breeding season, etc.) (Shivley et al., 2018). The value of the daily weight gain is influenced by factors

related to management practices such as the administration of colostrum, the amount of milk administered (Wieland et al., 2017; Tautenhahn et al., 2020) and its composition, climatic factors and microclimate, therefore it is necessary a holistic approach to them. The most important influencing factor during this period is nutrition, calves fed *ad libitum* with milk gained four times more than restricted-fed calves, which also showed signs of starvation (De Paula Vieira et al., 2008; Nica et al., 2023).

The hygiene of the bedding and the individual bunks as well as the group housing of the calves are organizational measures that indirectly improve the rate of growth by reducing the incidence of diseases (Horvath & Miller-Cushon, 2018; Lindner et al., 2021).

MATERIALS AND METHODS

The present study aims to highlight the influence of some factors such as age at first calving (AFC), female parity, birth weight (BW) of

calves and calving season on the daily weight gain (DWG) of calves.

DWG was calculated at 7 and at 30 days age, for a batch of 154 calves of the Romanian Black and white breed (Holstein strain), males and females, calved between June 2022 and July 2023. The analyzed batches were obtained after excluding individuals that they had digestive, respiratory or other pathologies during the reference period, causes that could have affected the growth rate of the animals. The results of the measurements were grouped according to the influencing factors followed, namely the age at first calving (AFC) and the parity of the cow, the birth weight (BW) of the calves and the calving season.

In the studied farm, calves are rearing in individual banks and during the first five days of life are fed with quality colostrum (≥ 30 °Brix) from the cows - mother or foster-mother. After the end of the colostrum period, they are fed daily with a quantity of 8 liters of whole milk distributed in two meals. A first assessment of body development was made 7 days, after the end of the colostrum period and then at 30 days. Weight assessment was done indirectly, based on chest circumference measurements and the

observed values were entered into the eWeigh application for cattle. Based on the assessed weight, the average daily gain at 7 days (DWG7) and at 30 days (DWG30) were calculated.

The primary data were statistically processed with the help of the SAVC (Statistics Analysis of Variance and Covariance) software, respectively SPSS 16.00 for WINDOWS. Thus, a series of statistical estimators were determined such as: the arithmetic mean (\bar{X}), the standard deviation of the arithmetic mean ($\pm s_{\bar{x}}$), the standard deviation (s), the coefficient of variability (V%), the Fisher Test and the Tukey Test, the significance test p. and the confidence interval (C.I.) (Cucu et al., 2004).

RESULTS AND DISCUSSIONS

The mean value of DWG7 in studied batch is 0.744 kg and for DWG30 it is 0.578 kg. For age at first calving, data on DWG7 and DWG30 values were grouped into three classes, namely: cows whose age at first calving was up to 800 days (approx. 26 months), those that had AFC between 801-860 days (26-28 months) and over 860 days.

Table 1. Statistical estimators for DWG (kg) depending on cows' age of first calving

Treats		n	\bar{X}	$\pm s_{\bar{x}}$	s	V%	Significance
AFC < 800 days	DWG7	74	0.750	0.052	0.443	59.339	n.s.
	DWG30	82	0.580	0.02	0.18	31.012	n.s.
AFC 801-860 days	DWG7	27	0.830	0.083	0.433	51.897	n.s.
	DWG30	36	0.590	0.028	0.169	28.817	n.s.
AFC > 860 zile	DWG7	20	0.730	0.058	0.258	35.256	n.s.
	DWG30	24	0.560	0.038	0.187	33.344	n.s.

n.s. - non-significant

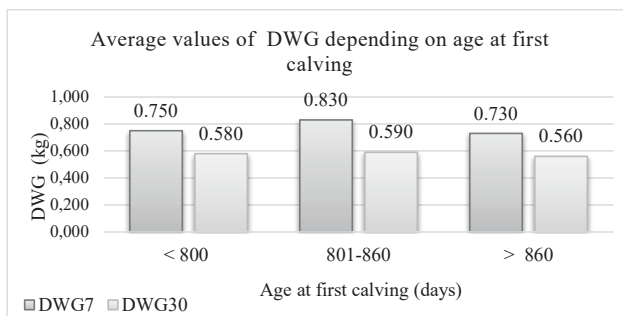


Figure 1. Mean of DWG depending on cows' age of first calving

From the analysis of the data summarized in Table 1 and the graphical representation in Figure 1, it can be seen that the highest mean values for both DWG7 and DWG30 were recorded in the calves of cows having AFC of 26-28 months. For the calves of these females the average AWG7 is 0.870 kg and the average

AWG30 is 0.590 kg. Character variability is high, the calf categories considered being very heterogeneous in terms of weight gain. By applying the Tukey test, no statistically significant differences were found between the samples ($p < 0.05$, CI = 0.95)

Table 2. Statistical estimators for DWG (kg) depending on parity

Traits		n	\bar{X}	$\pm s_{\bar{x}}$	s	V%	Significance
First calving	DWG77	61	0.74	0.054	0.424	57.304	n.s.
	DWG30	69	0.574	0.025	0.205	35.620	n.s.
Second calvin	DWG77	33	0.93	0.08	0.459	49.269	*s.
	DWG30	38	0.593	0.025	0.156	2.306	n.s.
Third calving	DWG77	25	0.63	0.071	0.357	56.372	*s.
	DWG30	31	0.555	0.024	0.132	23.836	n.s.
Fourth calving	DWG77	6	0.78	0.089	0.219	28.170	n.s.
	DWG30	8	0.617	0.056	0.157	25.490	n.s.

*s - significant ($p < 0.05$); n.s. - non-significant

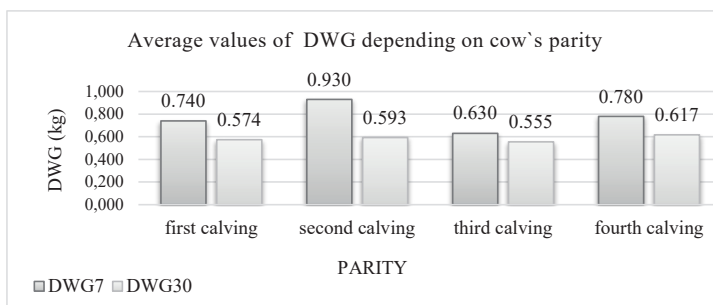


Figure 2. Average values of DWG depending on cow's parity

In Table 2 are displayed the calculated values of the statistical estimators of DWG7 and DWG30 according to cow parity. As can be seen also in Figure 2, the highest average value of 0.930 kg of DWG7 was recorded in the calves resulting from the second calving and in the case of DWG30 the highest value of the daily growth increment is 0.617 kg in the calves from a fourth calving. The DWG7 average of 0.780 kg is also

good in the case of calves from the fourth calving, the variability of trait in this case being medium homogeneous compared to the other categories characterized by heterogeneity. Statistically significant differences ($p < 0.05$, CI = 0.95) were found between the DWG7 of calves calved by cows on second calving having a mean value of 0.300 kg higher compared to that of calves from third calving dams.

Table 3. Statistical estimators for DWG (kg) depending on calves birth weight

Caractere		n	\bar{X}	$\pm s_{\bar{x}}$	s	V%	Significance
BW 30-40 Kg	DWG7	19	0.91	0.121	0.528	57.877	n.s
	DWG30	21	0.61	0.034	0.157	25.917	n.s
BW 40-50 Kg	DWG7	92	0.75	0.036	0.35	46.601	n.s
	DWG30	101	0.57	0.015	0.146	25.475	n.s
BW > 50 Kg	DWG7	21	0.74	0.121	0.555	75.415	n.s
	DWG30	32	0.58	0.047	0.264	45.864	n.s

n.s. - non-significant

The birth weight of calves is another factor considered for possible influence on DWG. Table 3 shows the calculated values of the estimators, in this case the heterogeneity of the

character can be observed for all weight categories of the calves, the V% coefficient having the lowest value of 25.5%.

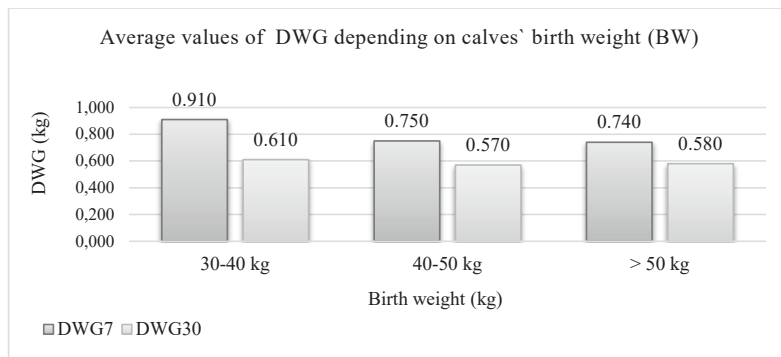


Figure 3. Average values of DWG depending on calves' birth weight

The graphic representation in Figure 3 of the values of the arithmetic means highlights the fact that the greatest increase in weight was that of the calves that had the lowest weight at calving, the SMZ value being 0.910 kg at 7 days and 0.610 kg at 30 days respectively days, with

insignificant differences between samples ($p < 0.05$, $CI = 0.95$). This highlights the fact that the calves that had the lowest weights at calving had a higher rate of development under the influence of factors other than the one considered, feeding being the most important.

Table 4. Statistical estimators for DWG (kg) depending on season

Season	Traits	n	\bar{X}	$\pm s_x$	s	V%	Significance
Summer	DWG7	58	0.8	0.062	0.471	59.158	n.s.
	DWG30	63	0.55	0.017	0.131	24.032	*s
Autumn	DWG7	32	0.84	0.076	0.429	51.27	n.s.
	DWG30	38	0.63	0.025	0.151	23.984	n.s.
Winter	DWG7	14	0.71	0.085	0.317	44.738	n.s.
	DWG30	17	0.67	0.069	0.284	42.302	*s
Spring	DWG7	28	0.68	0.059	0.315	46.254	n.s.
	DWG30	36	0.53	0.031	0.186	34.926	**s.

*s - significant ($p < 0.01$); **s - significant ($p < 0.05$)

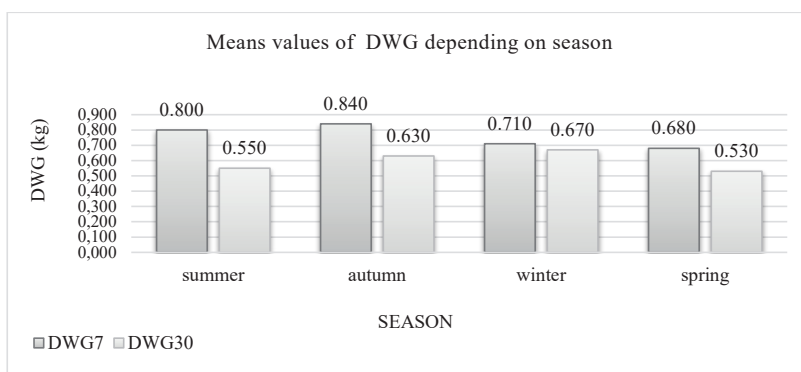


Figure 4. Values of mean for DWG depending on calves' birth weight

Regarding the DWG means according to the calving season, the highest average value for the end of the colostrum administration period is 0.840 kg/day and was recorded in the case of calves calved in autumn and the highest average of DWG30 is in the case of calves calved in winter, with a weight gain of 0.670 kg/day (Table 4 and Figure 4). Values of the coefficient of variation (V%) are over 24% which means that per season, the variability of the character is high. Distinctly significant differences were found between the mean DWG30 in favor of calves calved in winter compared to those calved in spring and summer, the difference between means values being 0.140 kg ($p < 0.01$, CI = 0.95) and 0.120 kg ($p < 0.05$, CI = 0.95). Percentage, spring and summer calved calves had average DWG30 with 21% and respectively 18% lower than those calved in the winter months.

CONCLUSIONS

The daily weight gain of calves is influenced by many factors. In this study, the aim was to highlight the influence of the age at first calving and the parity of the cow, the weight at calving and the season of calving on the DWG of the calves. From the values of the statistical estimators obtained after processing the DWG data, it can be concluded:

- the highest value of the DWG7 were 0.970 kg/day and was recorded for the calves of cows in their second calving and of DWG30 in the case of calves calved in winter which had a weight gain of 0.670 kg/day. The colostrum of multiparous cows has a richer content of antibodies, which is reflected in the health status of the calves;
- the average values of DWG7 are superior to those of DWG30 in all cases analyzed, the rich content of colostrum in nutrients favoring higher gains during this period;
- the values of the coefficient of variability have values higher than 20% in all cases considered, which means that the batch of calves analyzed has a high degree of heterogeneity in terms of weight gain;
- regarding the values of means for DWG30 in calves calved in winter compared to those calved in spring and summer, the differences are 0.140 kg and respectively 0.120 kg in favor of

those born in winter, with 21% and 18% higher averages values compared to calving in spring and summer;

- significant differences for DWG7 means were recorded between calves obtained from second-parous cows compared to those from third-parous cows, with the former having an average weight gain of 0.300 kg/day, which means that parity of the cows may be a factor of influence for weight gain on the colostrum period;
- in the case of the batches of calves analyzed, the age at the first calving of the cows and the birth weight of the calves do not influence the weight gain of those up to 7 and 30 days, the differences between the DWG averages being insignificant;
- the weight gain of the calves for the considered periods can be optimized by modulating environmental factors other than those analyzed and by appropriate managerial measures (administration of colostrum, the amount of milk provided as feed etc.).

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