ISSN 1330-7142
UDK = 636.08.12

FACTORS AFFECTING ACTUAL AND ADJUSTED 90-DAY, 205-DAY AND 365-DAY WEIGHT OF CHAROLAIS CALVES

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Original scientific paper

SUMMARY

Body weights on 90 ± 45 days and 205 ± 45 days are body weights used for selection in suckler herds, likewise body weight on 365 ± 45 days are used for selection in performance test according to the Slovenian rules for recording in animal production, which is based on the International Committee for Animal Recording - ICAR. Dilemma which body weights are more suitable: the actual, or the adjusted ones at the recommended age of calves is often present. Comparison between fixed effects on actual and on adjusted 90-day, 205-day and 365-day weights of Charolais calves have been studied. Calves (320) were born from 1995 to 2005 on Educational and Research Animal Husbandry Centre Logatec (Slovenia). Fixed effects of sex, parity, year of birth and birth weight were included in a model for the actual and adjusted body weights. Birth weight was included as linear regression. It has been concluded that parameters affected the actual body weights affected adjusted body weights, too. Birth weight and year of birth influenced 90-day, 205-day and 365-day weight. Parity influenced only 90-day weight, while sex influenced 205-day and 365-day weight. Coefficients of determination for adjusted 90-day weight (0.38), 205-day weight (0.38) and 365-day weight (0.73) were higher than for actual body weights (0.20, 0.30 and 0.60, respectively).

Key-words: Charolais, calves, body weight, actual weight, adjusted weight

INTRODUCTION

Guidelines for suckler herds recording from birth to weaning, recommend one weight taken at the calf′ age between 90 and 250 days (ICAR…, 2004). On this base, in our country, two weighing of calves at 90 ± 45 days and 205 ± 45 days are recommended. Weight at the age of 365 ± 45 days is recommended at the end of performance test period for beef breeds (Čepon et al., 2006).
Only the actual (raw) data should be recorded while weighing. However, the evaluation data should be adjusted to a defined age (90, 205, 365 days) with linear or other adjustment procedure (ICAR…, 2004). Body weight at 90 days and weaning weight are very important to beef producers, because they indicate the productivity of the dam (maternal traits) and the genetic potential of the calf′ pre-weaning growth.
Additionally, weaning weights also influence beef breeders' income. Weaning weights should be collected at the time the calf is weaned. For the correct adjustment purposes the average age of calves should be as close as possible to the age adjustment standard in a certain country (90, 205 and 365 days in Slovenia). Weaning weights should be taken when the average age of calves (in herd or group) is close to 205 days. Likewise, 90-day weight and yearling weight should be taken when the average age of calves (in herd or group) is around 90 or 365 days. If weights are not within the recommended interval (± 45 days) they should not be used as accurate.
On the other hand, even better statistical packages exist, recommending processing and evaluation of the actual (raw) data. Dilemma which body weights are more suitable: the actual (raw) or the adjusted ones at the recommended age of calves is often present.
The aim of this study was to find factors which affect the actual and the adjusted (interpolated) body weights and differences in the statistical significance between them. Coefficient of determination for the actual and the adjusted body weights were also interesting for us.

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MATERIAL AND METHODS

Our research included 320 Charolais calves, 171 males and 149 females, born in years 1995 - 2005. Calves were reared at the Educational and Research Animal Husbandry Centre Logatec (Slovenia). Cows, in the herd, calved in late winter or spring (January to June) calving season. The average grazing season lasted from the end of April or the beginning of May to the end of October. During all-day grazing, cows and calves had no additional concentrate on pasture, except mineral-vitamin mixture fed *ad libitum*. Pasture was located 470 m above the sea level on a karst plateau, with short vegetation period. The amount of rainfall differs among years, because there is the passage of mild Mediterranean and cold Alpine climate. The end of grazing season coincided the weaning time. Weaned calves were on the average 203 days old (almost 7 months). Weaned bulls, offspring of selected dams and sires, were housed in the performance test at the test station until the age of 365 days. Weaned heifers were wintered in sheds together with cows and next spring, on the average age of one year, they went to pasture.

Data of body weights on 90 ± 45 days, 205 ± 45 days and 365 ± 45 days were analysed. Calves were weighted within 90 day interval of the recommended age. For the actual weights non-interpolated weights within 90 day interval (90 ± 45 days, 205 ± 45 days and 365 ± 45 days) were used. Adjusted body weights were computed with interpolation at the recommended age of 90, 205 and 365 day (Table 1).

Only the main effects were used for the analyses because the preliminary analyses had shown that interactions among effects were not significant. Sex, parity, year of birth as fixed effects and birth weight as linear regression were included in the model.

Table 1. Descriptive statistic for the actual and the adjusted body weights

Days	Body weight	Actual		Adjusted	
	Sex	Male	Female	Male	Female
Birth	n	171	148	171	148
	BW (kg)	47.7 ± 6.6	46.0 ± 6.1	47.7 ± 6.6 actual	46.0 ± 6.1 actual
90 ± 45 days	n	140	116	137	110
	W_90 (kg)	127.8 ± 41.6	121.0 ± 37.6	130.9 ± 23.1	126.4 ± 21.4
	AA (days)	87.7 ± 24.5	83.6 ± 25.3	90	90
205 ± 45 days	n	130	114	130	103
	W_205 (kg)	270.4 ± 45.6	252.4 ± 45.1	270.5 ± 36.6	246.3 ± 37.9
	AA (days)	206.5 ± 21.1	203.7 ± 23.1	205	205
365 ± 45 days	n	117	36	117	83
	W_365 (kg)	451.5 ± 55.5	344.7 ± 40.6	458.2 ± 53.7	338.2 ± 37.3
	AA (days)	358.9 ± 9.9	386.4 ± 22.4	365	365

BW = birth weight, W_90 = 90-day weight, W_205 = 205-day weight, W_365 = 365-day weight, AA = average age

Fixed part of the model was analysed by GLM procedure of statistical package SAS/STAT (SAS Institute Inc., 2001). The general least square method was used for this purpose. Model (1) was used for the estimation of the actual and the adjusted 90-day, 205-day and 365-day weights.

$$y_{ijkl} = \mu + S_i + P_j + Y_k + b(x_{ijkl} - \bar{x}) + e_{ijkl} \quad (1)$$

Where:
y_{ijkl} = body weights (W_90, W_205, W_365), kg;
S_i = sex; i = 1, 2;
P_j = parity; j = 1, 2, 3;
Y_k = year of birth; k = 1, … 11;
x_{ijkl} = birth weight, kg;
e_{ijkl} = residual.

RESULTS AND DISCUSSION

The actual and the adjusted 90-day, 205-day and 365-day weights of Charolais calves in our study are shown in Table 1. Males had higher actual and adjusted body weights than females. The actual 90-day weights (124.7 kg) were lower than the adjusted 90-day weights (128.8 kg) of males and females together. In Canada (Crews et al., 2004) also adjusted weaning weight on 205-day, but values for the Canadian Charolais calves (W_205 = 292.41 kg) were higher than the adjusted W_205 of calves in our study (260.0 kg). Makulska et al. (2003) reported lower adjusted 210-day weight (253 kg) compared to the adjusted 205-day weight in our study (260.0 kg). Wolfová et al. (2004) investigated Charolais calves and adjusted 120-day, 210-day and 365-day weights. They reported higher birth weights (males = 47.7 kg, females = 46.0 kg) compared to Charolais calves in our study (males = 40.5 kg, females = 37.5 kg). Compared to Wolfová et al. (2004) calves had higher 365-day weight (males = 504 kg, females = 358 kg) than calves in our study (males = 458.2 kg, females = 338.2 kg). On the other hand, Krupa et al. (2005) have done a research on the actual weaning (LSM = 252.9 kg) and yearling weight (LSM = 399.5 kg) of Charolais calves and found similar values compared to our research, weaning (LSM; males = 267.8 kg, females = 250.3 kg) and yearling weights (LSM; males = 453.3 = kg, females = 345.8 kg), if we consider that their LSM included both sexes.
Comparison between fixed effects on the actual and the adjusted 90-day, 205-day and 365-day weights of Charolais calves have been studied (Table 2). Fixed effects of sex, parity, year of birth and birth weight were included in the model for the actual and the adjusted body weights. It has shown that source of variation which affected the actual body weights had influence on the adjusted body weights, too. Birth weight and year of birth influenced 90-day, 205-day and 365-day weight. Parity influenced only 90-day weight, while sex influenced 205-day and 365-day weight. Makulska et al. (2003) reported that sex affected on adjusted 210-day weight for Charolais calves in Poland. Krupa et al. (2005) conducted a research with actual weaning and yearling weights of six beef breed cattle. They found out that sex ($p<0.001$) affected on actual weaning and yearling weight. The effect of age on a weighing day as linear regression ($p<0.001$) also influenced body weight of the calves. Age would not affect body weights, if they were adjusted at the defined age (Krupa et al., 2005).

Table 2. Analysis of variance for the actual and the adjusted body weights

Source of variation	d.f.	Actual body weights (p-value)			Adjusted body weights (p-value)		
		W_90 ± 45	W_205 ± 45	W_365 ± 45	W_90	W_205	W_365
Sex	1	0.534	0.001	<0.001	0.112	<0.001	<0.001
Parity	2	0.003	0.847	0.793	0.017	0.707	0.775
Year of birth	10	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Birth weight	1	0.012	<0.001	<0.001	<0.001	<0.001	<0.001
R^2		0.20	0.30	0.60	0.38	0.38	0.73

W_90 = 90-day weight, W_205 = 205-day weight, W_365 = 365-day weight, d.f. = degrees of freedom, R^2 = coefficient of determination

We found out, that there was no statistically significant difference in factors affecting the actual and adjusted body weights. However, difference occurred in coefficients of determination for body weights. With the same model for the actual and adjusted body weights more variability for adjusted 90-day (38 %), 205-day (38 %) and 365-day weight (73 %) was explained than for the actual 90-day weight (20 %), 205-day weight (30 %) and for 365-day weight (60 %). The possible explanation of this event was the effect of age on the body weight at the day of weighing, which was eliminated at the adjusted body weights. Actual body weights on defined days (90 ± 45 days, 205 ± 45 days and 365 ± 45 days) of weighing included body weights of animals within 90 days interval. The difference between the youngest and the oldest animal in recommended weighing was 90 days or 3 months. Even the effect of mother milk production in months after calving, especially for 90 ± 45 days and 205 ± 45 days weight might be included in the established difference.

Table 3. Least squares means (LSM) and standard errors (SE) for the actual and the adjusted body weights (kg)

Body weight	Actual (LSM ± SE)		Adjusted (LSM ± SE)	
Sex	Male	Female	Male	Female
W_90	122.2 ± 3.9	119.2 ± 4.3	128.7 ± 2.0	124.9 ± 2.2
W_205	267.8 ± 4.3	250.3 ± 4.8	265.1 ± 3.5	245.1 ± 4.0
W_365	453.3 ± 5.3	345.8 ± 9.0	456.9 ± 4.8	339.3 ± 5.2

W_90 = 90-day weight, W_205 = 205-day weight, W_365 = 365-day weight

Least square means (LSM) and their standard errors (SE) for the actual and for the adjusted 90-day, 205-day and 365-day weights are presented in Table 3. LSM were higher for body weights of males compared to females for actual and adjusted body weights, too. Actual body weights on the 90 day and 365 day were lower than adjusted body weights of males and females. On the other hand, actual 205-day weight was higher than adjusted body weights for males and females.

Standard errors (SE) of actual and adjusted body weights were compared, too. Very interesting finding that SE were higher for all actual body weights compared to SE of adjusted body weights is shown in Table 3. The highest absolutely difference in SE was between the actual (9.0 kg) and adjusted (5.2 kg) W_365 of females. Lower standard error for adjusted body weights was understandable, because the estimated LSM for actual body weights included, beside genotype, the effect of different time or weighing day. Consecutively, there was a higher share of explained variability at the adjusted body weights. Relatively similar differences were seen if standard deviations of the actual and adjusted body weights were compared (Table 1).

CONCLUSION

We can conclude that parameters which affected the actual 90-day, 205-day and 365-day weights impacted the adjusted body weights, too. There was no statistically significant difference in factors affecting the actual and adjusted body weights. However, differences in coefficients of determination for body weights were observed. With the same model for the actual and adjusted body weights more variability was explained for adjusted than for the actual body weights.

LSM were higher for body weights of males compared to females for the actual and adjusted body weights, too. We also compared standard errors (SE) of actual and adjusted body weights. SE were higher for all actual body weights compared to SE of adjusted body weights which was very interesting. Similar differences between the actual and adjusted body weights were found at standard deviations of body weights, too. Higher share of explained variability was at the adjusted compared to the actual body weights.

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(Received on 15 May 2007; accepted on 28 May 2007)