

## Evaluation of the body conformation traits by system FleckScore and its relationship to longevity of Slovak Simmental cows

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Article Details: Received: 2020-10-28 | Accepted: 2020-11-27 | Available online: 2021-01-31

<https://doi.org/10.15414/afz.2021.24.mi-prap.155-158>



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The study is focused to analyse of the relationship between composite type traits evaluated by new system Fleckscore and functional length of productive life in the Slovak Simmental cows. All cows was scored in the first parity just because 85% data were censored. The score of frame, feet and legs, muscularity and udder was between 68 and 93 points. The lowest risk of culling was found for muscularity (0.591) at the group scored between 84 and 93 points, for udder (0.879) and feet and legs (0.751) scored between 77–79 points and for frame (0.816) at the score 80 points. Rate of culled cows on first or second parity was 15%. Within this group, diseases and fertility disorders (involuntary culling) represented 23% culling cows.

**Keywords:** body conformation trait, FleckScore, longevity, survival analysis

### 1 Introduction

The relationship between the body conformation traits and longevity in dairy cattle has been explored of many authors by different approaches (Sewalem et al.; 2004, Zavadilová et al., 2011; Imbayarwo-Chikosi et al., 2016; Novotný et al., 2017 and others). Composite traits and udder type traits have been used as indicator for length of productive life (Morek-Kopec and Zarnecki, 2012; Novotný et al., 2017). FleckScore system is new quality factor in the exterior assessment. Evaluation of the body conformation traits reflects the optimisation of the length of productive life in Simmental breeds in the Europe (Anzenberger, 2012; Ondráková, 2014).

The aim of this study was to evaluate relationship between longevity and the composite type traits in Slovak Simmental cows using Weibull proportional hazard model.

### 2 Material and methods

#### 2.1 Data

The data were provided by the Breeding Services of Slovak Republic, s.e. and Association of Slovak Spotted Cattle Breeders – Cooperative. The data comprised of 2596 Slovak Simmental cows with the first calving between February 2018 and February 2020. All cows were scored for type traits by system FleckScore in the first lactation. The composite traits as frame, feet and legs, muscularity and udder were evaluated in the interval between 68 and 93 points. Longevity was characterised as length of productive life (LPL) expressed as the number of days between the first calving to culling or censored. 85% data were censored by reason that cows have not been yet culled at the end of study or did not reach milk production higher as 1,700 kg.

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## 2.2 Model

The analyses were performed by the Survival Kit, v6.1 (Ducrocq et al., 2012). A Weibull proportional hazard model was used:

$$\Lambda(t) = \Lambda_0(t) \exp(p + m + hs + a + hys + sire + trait)$$

where:

$\Lambda(t)$  – the hazard function for a given cow at time  $t$ ;  $\Lambda_0(t)$  – the Weibull baseline hazard function;  $p$  – parity ( $n = 2$ );  $m$  – the milk production classes, expressed as a standard deviation from within-herd-year average ( $n = 6$ );  $hs$  – the herd size expressed as increase or decrease number of cows in comparison with last year ( $n = 6$ );  $a$  – age at first calving ( $n = 5$ );  $hys$  – the random time-dependent effect of the herd-year-season interaction with change points at April 1 and October 1 in each year ( $n = 219$ ); pedigree included of 109 sires of cows;  $trait$  – composite trait – analyse was performed four times, separately for each trait

Traits were grouped to 5 classes. Relationship between LPL and level of composite traits were expressed as the relative risk of culling (ratio of the estimated risk of being culled under the influence environmental factors relative to the reference risk (= 1). Risk ratio >1 represents a higher culling risk and vice-versa.

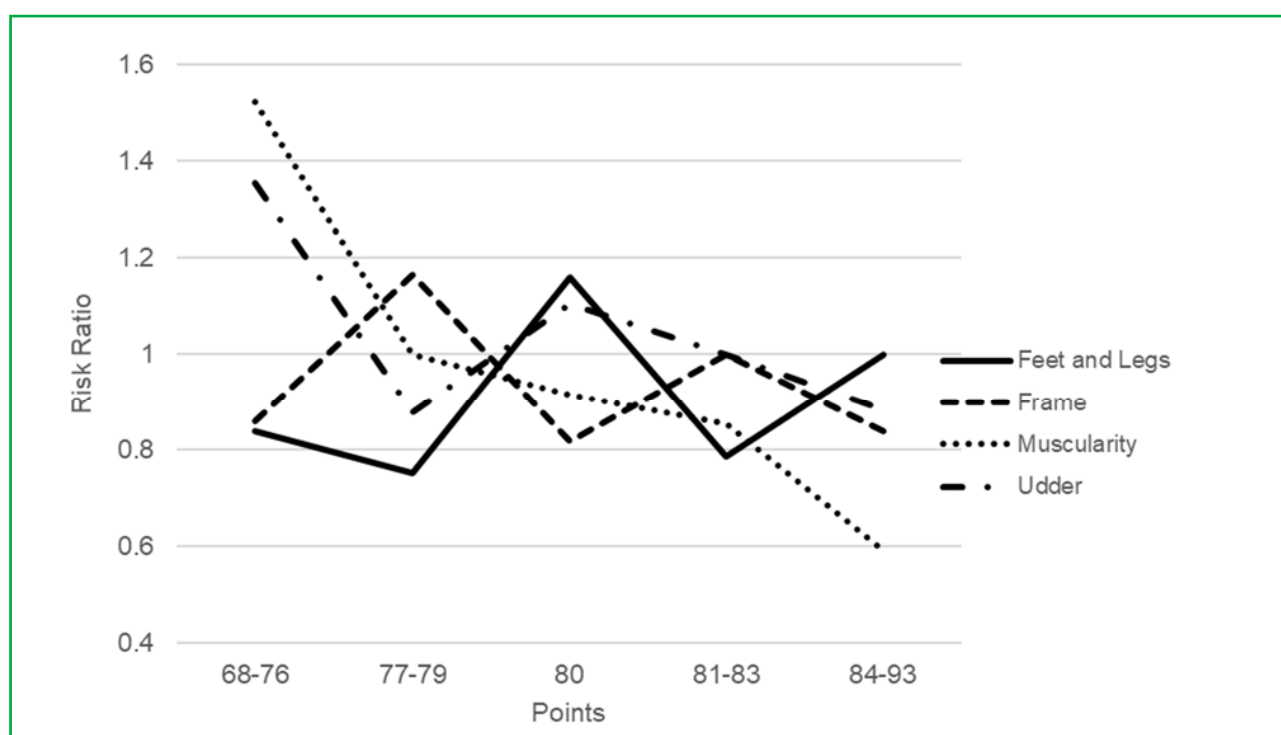
## 3 Results and discussion

Table 1 includes summary statistics of number and average age of cows by level of composite traits. The most cows reached score 81–83 points at each trait with exception of frame (84–93 points). Cows with score 84–93 points for muscularity, udder and frame, and 68–76 points for feet and legs achieved the highest LPL. Tanzler (2014) introduced optimum for frame 80–87 points, muscularity 80–84 points and feet and legs and udder 88–93 points in Simmental cows evaluated by FleckScore system.

**Table 1** Statistic by level of composite traits

Trait	Points	Number of cows	Number of culled cows	Average age of culled cows (days)	Average length of productive life for all cows (days)
Feet and Legs	68–76	310	44	296.73	410.66
	77–79	505	71	328.99	408.71
	80	272	43	321.26	391.54
	81–83	760	98	314.99	399.48
	84–93	749	112	345.34	400.96
Frame	68–76	388	56	320.20	397.56
	77–79	388	62	312.94	395.30
	80	209	25	324.48	406.81
	81–83	751	114	333.11	399.12
	84–93	860	111	327.52	409.00
Muscularity	68–76	142	31	299.97	401.61
	77–79	775	119	326.14	409.15
	80	640	83	327.45	396.89
	81–83	850	110	328.69	393.60
	84–93	189	25	333.24	430.92
Udder	68–76	447	88	308.34	385.76
	77–79	662	86	313.69	404.73
	80	297	45	304.11	396.52
	81–83	702	96	339.04	407.09
	84–93	488	53	366.62	410.29

Figure 1 shows relative risk of culling for the four composite traits. The highest number of records in class was given as the reference level. The lowest risk of culling was found at the score between 84 and 93 for muscularity (0.591), the score between 77 and 79 points for udder (0.879) and feet and legs (0.751) and at the 80 points for frame (0.816). Clear linear decreasing trend of relative risk culling was observed on muscularity trait with the highest risk of culling in class of the least muscular cows. Comparable trend was recorded also on udder trait. Zavadilová et al. (2011) found the lowest risk of culling at the score 80–84 points for udder and feet and legs in Holstein cows. The relationship between longevity and type trait confirmed also Sewalem et al. (2004) that reported linear relationship between mammary system and longevity. Udder traits, such as fore udder attachment, udder texture, and udder depth, were the most important, with a strong relationship with functional survival of cows. Sawa et al. (2013) calculated the highest phenotypic correlation between lifetime performance and udder score ( $r = 0.22$ ) and legs and feet ( $r = 0.13$ ). Imbayarwo-Chikosi et al. (2016) found that among the udder traits, fore teat placement had the greatest influence in the relative risk of culling cows. Novotný et al. (2017) confirm genetic correlations of udder depth and two composite traits – udder and feet and legs with functional longevity. Authors stated that selection for fore and rear udder length and high rear udder attachment may contribute to high length of productive life of Czech Fleckvieh cattle.



**Figure 1** Risk ratio of culling for composite traits

Table 2 shows number of cows culling on first or second parity (413 cows; 15%). Within this group, diseases and fertility disorders (involuntary culling) represented 23% culling cows. Breeding reasons, low milk yield and sale of cows (voluntary culling) reached 54% of cows. Frelich et al. (2010) found an increase in the frequency of culling for other health reasons from 19% to 41% in the Czech Fleckvieh cows. Ansari-Lari et al. (2012) state involuntary causes 73.9% of all culled cows, mainly due to infertility and others diseases.

**Table 2** Number of cows by reason of culling

Reason of culling	Number of cows	Percent
Transfer of cows out of milk recording system	45	10.90
Low milk production	44	10.65
Breeding reasons	29	7.02
Udder disease	9	2.18
Fertility disorders	26	6.30
Difficult parturition	1	0.24
Other diseases	32	7.75
Death	48	11.62
Defeat necessary	27	6.54
Slaughterhouse sale	152	36.80

#### 4 Conclusions

Longevity and length of functional productive life of cows are result of many factors interaction such as health condition, management, environment, welfare and others. An indirect estimation of length of productive life by Fleckscore system evaluation of conformation traits reflects all factors mentioned above.

#### Acknowledgments

Paper was supported by project KEGA 012SPU-4/2019.

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