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Comparative study for adjusting scrotal circumference (s.c.) in Charolais and Hungarian Simmental young bulls

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ABSTRACT

This study was conducted to compare two different methods for calculating the scrotal circumference (ASC_1, ASC_2,) adjusted to 365 days of age at the end of the self performance test under different conditions. Charolais and Hungarian Simmental young breeding bulls (farm A: n=40; station B: n=80) were investigated in this study. The scrotal circumference (S.C.) of young bulls was measured at the widest part of the scrotum at the end of the test (Charolais: S.C.=37.8 cm; Hungarian Simmental: S.C.=37.7 cm). The differences between the results as calculated using method I (ASC_1) and method II (ASC_2) were as follows: Charolais: -1.3 cm, P<0.001; Hungarian Simmental: +1.1 cm, P<0.001. It would seem that the two methods tested for calculating adjusted scrotal circumference produced very different results. High positive correlations were calculated (r=0.92-0.99) between measured S.C. and the two adjusted scrotal circumferences (ASC_1 and ASC_2). The results of the present study suggest that both method I (ASC_1) and method II (ASC_2) can be used by breeders in the calculation of adjusted scrotal circumference. The S.C. of bulls seems generally to be related to live weight and age of bulls; therefore, breeders are recommended to use method I (ASC_1).
(Keywords: beef bull, scrotal circumference, selection)

ÖSSZEFOGLALÁS

Módszertani tanulmány charolais és magyartarka bikák herekörméretének (s.c.) korrigálására

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A tanulmány célja a korrigált herekörméret két számítási módszerének összehasonlítása a különböző feltételek mellett folyó sajátteljesítmény-vizsgálat végén charolais (A: üzemi, n=40) és magyartarka (B: központi, n=80) bikák esetében. A növendékbikák herekörméretét a szkrotum legszélesebb részén mérve a vizsgálat végén mértük meg (charolais: S.C.=37,8 cm; magyartarka: S.C.=37,7 cm). Az I. és a II. második korrigálási eljárás átlageredményei között az alábbi eltéréseket tapasztaltuk: charolais: -1,3 cm, P<0,001; magyartarka: +1,1 cm, P<0,001. Úgy tűnik tehát, hogy a két korrigálási módszer nagyon különböző eredményt adhat. Az eredeti és a korrigált herekörméret értékek között szoros (r=0,92-0,99) összefüggést találtunk. Az eredmények arra is utalnak, hogy a tenyésztők a herekörméretek korrigálására mindkét módszert

használhatják. A bikák herekörmérete (fejlettsége) általában összefüggésben van az életkorral és az élősúllyal, ezért a tenyésztőknek az I. módszer alkalmazását javasolhatjuk.
(Kulcsszavak: húsfajtájú bika, herekörméret, szelekció)

INTRODUCTION

Scrotal circumference (S.C.) of young bulls is a potentially useful indicator of reproductive potential in beef cattle. S.C. has been shown to correlate positively with total sperm production (*Hahn et al.,* 1969; *Coulter and Foote*, 1979; *Laszczka and Wierzbowski*, 1984; *Belloir et al.,* 1984; *Zhang et al.,* 1993; *Gábor et al.,* 1997) and with the quality of sperm (*Brinks et al.,* 1978; *Knights et al.,* 1984; *Gipson et al.,* 1987; *Temblador and Gonzalez,* 1988; Polupan 1994), but negatively with age at puberty (*Brinks et al.,* 1978; *King et al.,* 1983; *Vargas et al.,* 1997). S.C. has been found to be correlated positively with the age at puberty in daughters (*Moser et al.,* 1996), pregnancy rates, age at first breeding and age at first calving in females (*Toelle and Robinson,* 1985; *Lunstra,* 1985; *Smith et al.,* 1987).

In most of the previous reports the heritability estimated for S.C. ranged between 0.4 and 0.7 (*Coulter and Keller,* 1979; *Neely et al.,* 1982; *Latimer et al.,* 1982; *Lunstra et al.,* 1985; *Lunstra et al.,* 1988; *Kriese et al.,* 1991; *Gregory et al.,* 1995; *Keeton et al.,* 1996; *Shepard et al.,* 1996).

If the S.C. in yearling bulls is used as a selection criterion, attention should be paid to adjustments to account for differences in age (*Bell et al.,* 1996) and age of dam (*Kress et al.,* 1996) among bulls.

The following adjustment formula is generally used in the USA (*Lunstra et al.,* 1985): Adjusted S.C.=((linear regression coefficient)×(365-actual age of bull in days)+(actual S.C.))+age of dam adjustment

Some linear regression coefficients (b) for S.C. (Hereford, n=4233, b=0.026 cm/day; Hereford and Angus, n=779, b=0.024 cm/day; Limousin, n=222, b=0.026 cm/day; Charolais, n=197, b=0.013 cm/day; Simmental, n=238, b=0.034 cm/day; 12 breed, n=3094, b=0.032 cm/day) were demonstrated by *Lunstra et al.* (1985); *Bourdon and Brinks* (1986) and *Smith et al.* (1987). In 1996, the linear regression coefficient (b=0.0312 cm/day) for S.C., based on 50,672 Angus yearling bulls, was proposed by *Wilson* (1996). In this case the average S.C. was just over 36 cm and extreme values ranged between a low of 21 cm and a high of 50 cm. It is very interesting that the standard deviation of this Angus population was just over 3 cm.

In Hungary, *Tőzsér et al.* (1993) reported some linear regression coefficients for age (n=51, b=0.028 cm/day; n=50, b=0.050 cm/day) and live weight (n=51, b=0.039 cm/kg; n=52, b=0.032 cm/kg) in Charolais bull calves of 6-7 months of age. The adjustment of scrotal circumference for age and live weight in Charolais bulls of 12-14 months of age has already been calculated by *Tőzsér et al.* (1995). The linear regression coefficient for Hungarian Simmental young breeding bulls for age (n=40, b=0.036 cm/day) has also been reported (*Tőzsér et al.*1992).

Pratt et al. (1991) compared two methods (simple method and method of regression analysis) for adjusting scrotal circumference to 365 days of age and found that overall means calculated for each method were not different between the two sets of data.

The present study was conducted to compare results for two different methods for calculating the adjusted scrotal circumference to 365 days of age in Charolais and Hungarian Simmental young bulls at the end of the self performance test, under farm conditions and in a central self performance test station.

MATERIALS AND METHODS

Young Charolais and Hungarian Simmental breeding bulls (farm A: n=40; station B: n=80) were investigated in this study. The young Charolais bulls were kept in a loose housing system, in small groups, and were fed a diet based on corn silage and concentrate. In contrast the young Hungarian Simmental breeding bulls were kept individually in cubicle housing, and were fed a diet based on ad libitum concentrate and on rationed corn silage and grass hay.

The scrotal circumference of young bulls was measured using a centimetre band at the beginning and at the end of the test, at the widest part of the scrotum (*Taylor,* 1984).

The adjustment of scrotal circumference was calculated by two different methods, as follows:

- method I (ASC_1) according to *Tőzsér et al.* (1995):
  $ASC_1=SC_2+(b_1\times(AAGE-AGE_2))+(b_2\times(W_2-AW))$,
  where:
  ASC_1=adjusted scrotal circumference, cm
  SC_2=measured scrotal circumference at the end of the test, cm
  AAGE=average age of bulls at the end of the test, days
  AGE_2=actual age of bulls at the end of the test, days
  b_1=adjustment factor for age, cm/days of age (Charolais: -0.014 cm/day; Hungarian Simmental: 0.033 cm/day)
  W_2=actual live weight of bulls, kg
  AW=average live weight of bulls at the end of the test, kg
  b_2=adjustment factor for live weight, cm/kg (Charolais: -0.003 cm/kg; Hungarian Simmental: 0.018 cm/kg)
- method II (ASC_2) according to *Lunstra et al.* (1985):
  $ASC_2=SC_2+b_1\times(365-AGE_2)$,
  where:
  ASC_2=adjusted scrotal circumference, cm
  SC_2=measured scrotal circumference at the end of the test, cm
  365=constant for age of bulls, days
  AGE2=actual age of bulls at the end of the test, days
  b1=adjustment factor for age, cm/days of age (Charolais: -0.014 cm/day; Hungarian Simmental: 0.033 cm/day)

To describe the relationships between measured (S.C.) and adjusted (ASC_1 and ASC_2) scrotal circumference, the method of linear analysis of regression (one-variable) and correlation was used (*Snedecor and Cochran,* 1976). The differences between the means compared were determined by paired Student t-test.

RESULTS AND DISCUSSION

The average values for age, live weight and scrotal circumference of young Charolais and Hungarian Simmental bulls are summarised in *Table 1.*

Table 1

Age, live weight and scrotal circumference of young Charolais and Hungarian Simmental bulls at the end of the test (mean±S.D.)

Parameter (1)	Farm A (2) (Charolais)	Station B (3) (Hungarian Simmental)
Number of bulls (4)	40	80
Age (days) (5)	463±37.80	397±21,57
Live weight (kg) (6)	602±54.23	560±72.47
Scrotal circumference (cm) (7)	37.8±2.66	37.7±2.54

1. táblázat: Charolais és magyartarka növendékbikák életkora, élőtömege és herekörmérete (átlag és szórás) a sajátteljesítmény-vizsgálat végén

Tulajdonságok(1), Üzemi vizsgálat(2), Központi vizsgálat(3), Egyedszám(4), Életkor, nap(5), Élőtömeg, kg(6), Herekörméret, cm(7)

The measured S.C. for Charolais and Hungarian Simmental bulls at the end of test was similar to findings published by *de Rose et al.* (1988), *Schramm et al.* (1989) and *Tőzsér et al.* (1996). The minimum scrotal circumferences (32 cm) for Charolais and Simmental bulls of 12-14 months of age were reported by *Coulter* (1986). So, the objective of breeders should be to select superior bulls, not those barely adequate.

The results for the two different methods for calculating scrotal circumference adjusted to 365 days of age are shown in *Table 2.*

Table 2

Mean and standard deviation for adjusted scrotal circumferences of young Charolais and Hungarian Simmental bulls by two different methods

Parameter (1)	Farm A (2) (Charolais)	Station B (3) (Hungarian Simmental)
Number of bulls (4)	40	80
Adjusted scrotal circumference 1 (cm) ASC_1 (5)	37.8±2.61	37.7±3.27
Adjusted scrotal circumference 2 (cm) ASC_2 (6)	39.1±2.61	36.6±2.44

2. táblázat: Charolais és magyartarka növendékbikák korrigált herekörméretének átlag és szórás értékei, két különböző módszerrel

Tulajdonságok(1), Üzemi vizsgálat(2), Központi vizsgálat(3), Egyedszám(4), Korrigált herekörméret 1, cm(5), Korrigált herekörméret 2, cm(6)

Method I (ASC_1) for adjusted S.C. produced mean values identical to those obtained without adjustment, but the values of standard deviation were different in the Hungarian

Simmental breed (2.54 vs. 3.27). The two values of standard deviation (2.66 vs. 2.61) were identical in the Charolais bulls.

For both breeds the results of the t-test showed that the differences between the means of the measured values and SC_2 were statistically different at $P<0.001$ level of significance. The differences between the results as calculated using method I (ASC_1) and method II (ASC_2) were as follows: Charolais: -1.3 cm, $P<0.001$; Hungarian Simmental: +1.1 cm, $P<0.001$). It would seem that the two methods tested for calculating adjusted scrotal circumference produced very different results. These results were the opposite to those obtained by *Pratt et al.* (1989).

Altought in the present study high positive correlations were calculated (r=0.92-0.99) between measured S.C. and the two adjusted scrotal circumferences (ASC_1 and ASC_2) it is possible to account for these correlation coefficients by the procedures of adjustment *(Table 3).* The correlation values (r) for SC_1 and SC_2 varied between 0.94 and 0.99 ($P<0.001$).

Table 3

Correlation coefficients (r) between measured (S.C.) and the two adjusted scrotal circumferences (ASC_1 and ASC_2)

Herd and number of bulls (1)	Traits (4)	S.C. (5) (cm)	ASC_1 (6) (cm)
Farm A (2) (Charolais) n=40	ASC_1 (cm) (6)	0.99*	-
	ASC_2 (cm) (7)	0.98*	0.99*
Station B (3) (Hungarian Simmental) n=80	ASC_1 (cm) (6)	0.92*	-
	ASC_2 (cm) (7)	0.96*	0.94*

Abbreviations *(Rövidítések)*: S.C.: actual scrotal circumference (*mért herekörméret*) ASC_1 and ASC_2: adjusted scrotal circumference (*korrigált herekörméret*)
Level of significance *(Szignifikancia szint)*: *P<0.001

3. táblázat: A mért és a két korrigált herekörméret közötti korrelációs együtthatók

Állomány és egyedszám(1), Üzemi vizsgálat(2), Központi vizsgálat(3), Tulajdonságok(4), Herekörméret, cm(5), Korrigált herekörméret 1, cm(6), Korrigált herekörméret 2, cm(7)

The results of the present study suggest that both method I (ASC_1) and method II (ASC_2) can be used by breeders in the calculation of adjusted scrotal circumference. The S.C. of bulls seems generally to be related to live weight and age of bulls; therefore, breeders are recommended to use method I (ASC_1).

The following conclusions can be drawn from this study:

- To assess the reproductive status, the scrotal circumference of young beef bulls can be measured and adjusted to 365 days of age or age and live weight using a type of adjustment formula.
- The use of different calculations for adjusted scrotal circumference can give very different results.
- This investigation needs to be repeated and corroborated with new samples for beef bulls.

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