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EFFECT OF COLLECTION SEASON AND BREED ON SOME TRAITS OF BEEF BULL SEMEN

Abstract. The investigations were carried out on the beef bulls semen collected from the following breeds: Simmental, Limousine, Charolaise, Piemontese, Blonde d'Aquitaine. Ejaculates were obtained in 2008-2009 in Masovian Centre of Animal Breeding and Reproduction in Łowicz. The aim of this study was to exam the impact of bulls breed and collection season on some characteristics of ejaculates: volume, sperm concentration, % of live sperm in the ejaculate and % of morphological defects of spermatozoa. Among the five studied breeds, Simmental breed showed the best parameters of semen (the largest volume, sperm motility and the littlest morphological defects of spermatozoa in ejaculate). The top in the concentration of spermatozoa was found for Blonde d'Aquitaine bull. The worst parameters of semen (volume and sperm concentration) showed Piemontese breed. The weakest sperm motility was observed in Charolais breed, but the percentage of the morphological defects was the highest in Limousine breed. Month of semen collection also influenced the parameters of ejaculates. The largest volume was recorded in May, June and September and the lowest in the autumn and winter months. The motility of sperm- the best values were obtained mainly in the spring (III, IV, V) and in the September and the worst in July and November (in three of the five breeds). The highest concentration of spermatozoa was in I, II, III, XI and the worst in months: IV, VIII, IX, XI. The lowest percentage of morphological defects in the semen was in ejaculates collected in April (for four out of five breeds) and in XII. Most defects were recorded in months: I, VI, IX, XI, XII. Based on the results it could be concluded that season and breed has an effect on volume, sperm concentration, sperm live in ejaculates and % of morphological defects of spermatozoa obtained from beef bulls used for insemination.

Key words: *beef bull, semen, breed, season*

Introduction. In the recent years interest of beef cattle breeding increased in Poland. Also the number of dairy cows inseminated by specialized beef bulls semen rapidly increased. The commercial crossbreeding caused the significant improvement of fattening and slaughter traits in crossbreds (Grodzki, Przysucha 2010). The success of commercial crossbreeding depends on many factors. The one of them is semen quality and quantity. The ejaculates of beef bulls were collected and examined in many Breeding Centre for Animal Reproduction in Polen. However, as shown by numerous studies, sperm production by males depends on genetic and environmental factors, which can significantly affect on its the quality and quantity (Pileckas et.al, 2007).

Task, the aim of the article

The aim of presented study was to analyze the influence of breed and season collection on the parameters of bulls semen used for artificial insemination.

Materials and methods

The examination was conducted on the semen collected from 13 beef bulls, including 3 Simmental (SM), 7 Limousine (LM), 1 Charolais (CH), 1 Piemontese (PI), 1 Blonde d'Aquitaine (BD) breed used in 2008-2009 in the Breeding Centre for Animal Reproduction in Łowicz.

Semen was collected by artificial vagina use. The following semen parameters were evaluated: volume of ejaculate (ml), concentration of spermatozoa in the ejaculate (thous./mm³), percentage of live sperm in the ejaculate showing progressive motion and sperm morphology (%).

The following statistical model of multivariate analysis of variance by the least squares was used (SPSS 14.0.)

$$Y_{ijk} = \mu + a_i + b_j + ab_{ij} + e_{ijk}$$

Y_{ijk}-value of trait

μ - the average of the trait

a_i - effect of bull breed

b_j - effect of month

ab_{ij} - breed x month interaction

e_{ijk} - error

The significance of differences was estimated by Fisher test.

The following breakdown of months of the year to seasons was used.

(Spring; March, April, May,

- Summer; June, July, August,

- Autumn; September, October, November,

- Winter; December, January February).

Results of researches:

The data contained in table 1 shows the diversity of semen parameters of different breeds. The largest volume characterized semen collected from Simmental bulls, where average volume was 5.41 ml and statistically differed ($P \leq 0,01$) from ejaculates of Piemontese bull (mean 2.91 ml), Limousine (mean 4,41 ml) and Blonde d'Aquitaine (mean 4,45%). Similar results of volume of ejaculates was received for Blonde d'Aquitaine and Limousine. In presented study, the smallest volume of semen showed Piemontese bull (average 2,91 ml), and was significantly different ($P \leq 0,01$) than the average volume of the ejaculates of the other breeds.

The average level of sperm motility was 73,45% (table 1).

The highest percentage of sperm moving with advancing motion was found for Simmental breed (average 79.91%) The difference was statistically important ($P \leq 0,01$) compared to Charolaise, Limousine and Piemontese breeds. Similar, but slightly lower results were obtained for Blonde d'Aquitaine bull (mean 76.69%). The smallest value of this trait was recorded for Charolais breed (65.45%).

The concentration of spermatozoa of all tested breeds was 1236,86 thous./mm³ as average (table 1). Blonde d'Aquitaine bull had the highest concentration of spermatozoa (mean 1624,99 thous./ml). That value differed significantly ($P \leq 0,01$) from the average concentration of spermatozoa in ejaculates of Charolaise (mean 877,79 thous./ml), Limousine (mean 1409,17 thous/ml) and Piemontese breeds (mean 791,34 thous./ml). The smallest value of this trait was noticed for Piemontese breed and differed significantly ($P \leq 0,01$) from the average concentration of spermatozoa in ejaculates of other studied breed.

The smallest percentage of morphological defects was observed in the semen of Simmental bulls (2.80%) and the largest one in Liomusine ejaculates (4.79%) ($P \leq 0,01$).

Table 1.

Ejaculate characteristics depending on the breed

	Volume (ml)		% of sperm motility		Concentration (thous./ml)		Morfology (%)	
	LSM	SE	LSM	SE	LSM	SE	LSM	SE
	4,49	0,05	73,45	0,42	1236,86	13,73	3,76	0,15
Breed	LSM	SE	LSM	SE	LSM	SE	LSM	SE
BD	4,45 ^{AD}	0,16	76,69 ^{Aa}	1,27	1624,99 ^A	41,52	3,22 ^{aA}	0,40
CH	5,25 ^{AB}	0,13	65,45 ^{AB}	1,05	877,79 ^{AB}	34,31	4,45 ^{ab}	0,43
LM	4,41 ^{BC}	0,06	72,95 ^{AC}	0,50	1409,17 ^{AC}	16,50	4,79 ^{ACD}	0,18
PI	2,91 ^{ABC}	0,13	72,54 ^{ab}	1,04	791,34 ^{AD}	33,94	3,53 ^C	0,38
SM	5,41 ^{CD}	0,09	79,91 ^{abc}	0,69	1513,37 ^{BCD}	22,57	2,80 ^{BD}	0,23

LSM - least square mean

SE - error

A, B are different at $P \leq 0,01$; a, b are different at $P \leq 0,05$

Figure 1 presents the dynamics of change of ejaculates volume of different breeds depending on the season. The minimal volume of ejaculate was observed for Piemontese bull (mean 1,84 ml) in January and in December (mean 1,87) (winter season). However, the highest value of this trait was found for Simmental (mean 6,22 ml) in September (autumn season). Despite of bull breed the lowest ejaculates volumes were noticed in the autumn and winter months. The same results were published by Miciński et al (2001), Mroczek (2006), Drazdzyński and Grodzki (1981), Gumowski (1971), and Stenzel and Kamieniecki (1993). The lower volume of semen from bulls during the summer was observed by Klupczyński et al (2004) who studied the effect of season and other factors on the characteristics of beef bull semen. In figure 2 variations in the proportion of live sperm in ejaculates depending on the breed of the bull in each month of the year was shown.

The lowest percentage of live sperm was found for Charolaise (mean 40%), Limousine (mean 65%) and Piemontese (mean 56,6%) in November (autumn season). This is confirmed by research of Gumowski (1971), where the lowest percentage of motile sperm in bull semen received from September to November. Stenzel and Kamieniecki (1993) observed that the best sperm motility was in the winter. The

results of presented study are slightly different, because two other breeds the lowest values obtained also in July. However, in the ejaculates of the bulls was not the highest value of this trait recorded in the winter. The largest value of this trait was noted in September (Piemontese; mean 82,9%). In Simmental breed the best result was obtained in May (82,21%) and throughout the year the level of sperm motility was remained at the same level. In Blonde d'Aquitaine the best result was obtained in April (80.23%) and from August to October the values of this trait were very similar noted. The lowest percentage of live sperm was occurred in July (73.46%). In Limousin bull sperm motility was remained at a similar level from January to March. During the spring and summer months (from April to August), the sperm motility was decreased. The best result was obtained in September (76.73%). In Piemontese live sperm was remained stable from February to April and after that decreased to July and again rised to September. From September this values was dropped. Charolais bull the largest percentage of live sperm was obtained in March (75.31%).

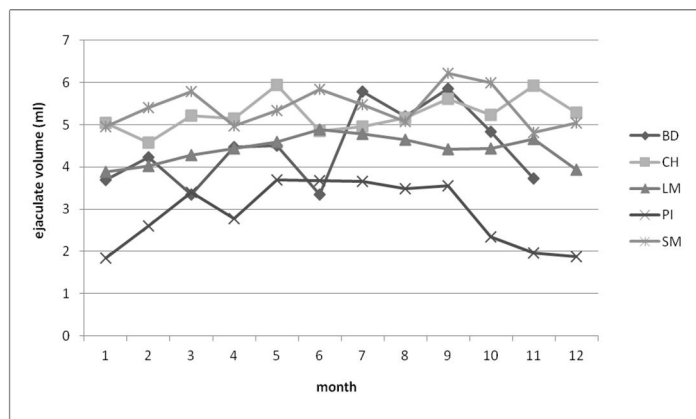


Figure 1. Changes in volume of ejaculate depending on the season and breed

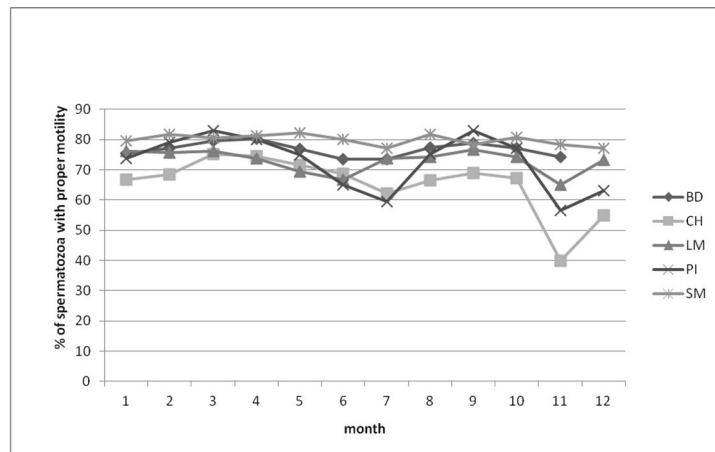


Figure 2. Changes in sperm motility in bulls ejaculates depending on the month

Figure 3 shows dynamic spermatozoa concentration in semen of different breeds, depending on the month.

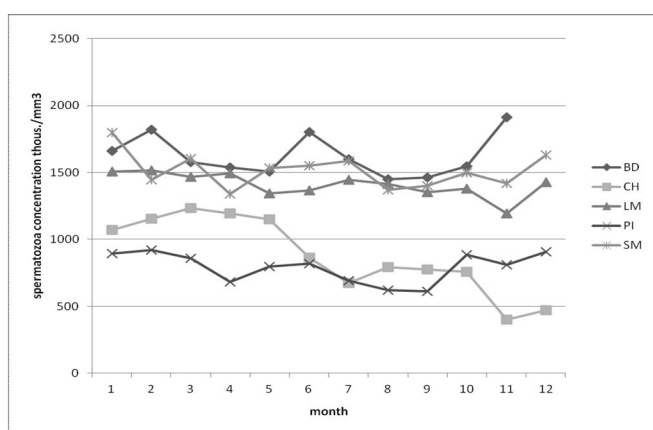


Figure 3. Changes in concentration of spermatozoa, depending on the month of sperm collection and breed

The highest concentration had ejaculates collected from Blonde d'Aquitaine bull and the highest concentration of sperm in the semen was obtained in November (an average 1911.67 thous. / ml), and the lowest in August (1450.06 thous./ ml). Simmental breed had the highest concentration of spermatozoa per ejaculate in January (1798.05 thous./ ml), and the lowest in April (1339.14 thous. / ml). Limousin and Piemontese breeds the highest value of this trait obtained in February (an average 1561.72 and 918.89 thous./ml, respectively.) and lowest in November (1193.81 thous./ ml, Limousine breed) and in September (611.47 thous./ ml, Piemontese breed). Charolais bull the highest level of this trait obtained in March (1233.94 thous. / ml), and the lowest in November (400.83 thous. / ml). In four of the five breeds, the highest concentration spermatozoa in ejaculates was recorded in the autumn and winter months, which confirms with the results obtained by Gumowski (1971). Mroczek (2006), the highest concentration of spermatozoa in bulls semen found in the spring, which is consistent to the results noted for the Charolais breed in this study. Figure 4 shows changes in morphology of ejaculates depending on the month of the year.

In bulls of all breeds, except Limousin, the smallest morphological defects in sperm were observed in April. The results obtained in this study were contradictory to the results noted by Miciński et al (2001), which the best results of spermatozoa morphology in bulls ejaculates stated in the summer. Limousin breed had the lowest value of this trait in December (3.39%). In the remaining month of the year, the percentage of morphological defects of spermatozoa in ejaculates was above 4. The highest percentage of morphological defects were noticed for Simmental breed in June (mean 4.17%), for Blonde d'Aquitaine in January and September (mean 4.00%), in Piemontese in November (8.87%), and for Charolais breed in December (6, 67%) and Limousin in January (6.98%). In all breeds percentage of morphological defects

in bull ejaculates was the highest in June, which was also reported by Klupczyński et al (2004), where the sperm morphological defects occurred during the summer. In presented study the morphological defect of spermatozoa was high also in the of autumn and winter months.

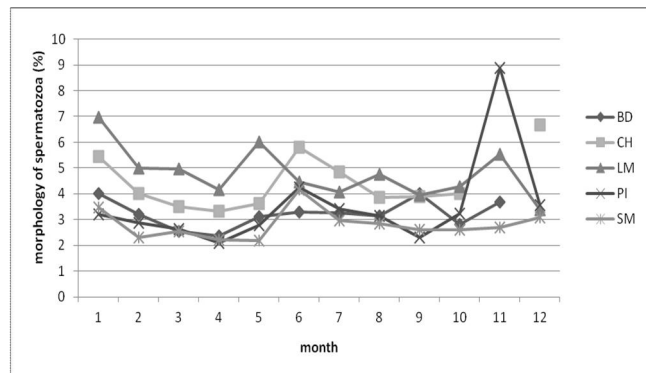


Figure 4. Changes in morphology of spermatozoa in ejaculates of different breeds

Conclusions

Based on the results it can be concluded that season and breed has an effect on volume, sperm concentration, sperm live and percentage of morphological defects in spermatozoa in ejaculates from bulls semen used for insemination.

Among the five breeds, Simmental showed the best semen parameters (the largest volume, sperm motility and the littlest morphological defects of spermatozoa in ejaculate). The top of concentration of spermatozoa was found for Blonde d'Aquitaine breed. The worst parameters of semen (volume and sperm concentration) were found for Piemontese breed. The weakest sperm motility was observed in Charolais breed. The percentage of the morphological defects was the highest in Limousine bulls.

The parameters of bull semen depending on the month was:

Volume - The highest was recorded in the May, June and September and the lowest in the months of autumn and winter (I, II, XI).

The motility of sperm- the best value were obtained mainly in the spring (III, IV, V) and in the September and the worst in VII and XI (in three of the five breeds).

Concentration of spermatozoa in bull ejaculates – the best value was in I, II, III, XI. The worst in months: IV, VIII, IX, XI.

Morphology - percentage of morphological defects in the semen was in ejaculates collected in April (in four out of five breeds) and in XII. Most defects were recorded in months: I, VI, IX, XI, XII.

References

1. Grodzki H., Przysucha T., 2010: Krzyżowanie towarowe jako jedna z metod zwiększania ilości i poprawy jakości wołowiny. Przegląd Hodowlany 11, 3-7;

2. Pilecka V., Kutra J., Urbšys A., 2007: The influence of the genotype on the quantitative traits of bosine semen. *Veterinarija ir Zootechnika* 40 (62),73-77,
3. Miciński J., Klupczyński J., Nogalski Z., 2001: Zmiany niektórych cech nasienia młodych buhajów rasy Limousin w zależności od wybranych czynników środowiskowych. *Biuletyn Naukowy UWM w Olsztynie* 11, 166-177;
4. Drażdżyński B., Grodzki H., 1981: Wpływ wieku i pory roku na jakość nasienia buhajów. *Medycyna Weterynaryjna* 37, 104-105
5. Gumowski B., 1971: Sezonowe zmiany niektórych właściwości nasienia buhajów. *Przegląd Hodowlany* 12, 21-23;
6. Klupczyński J., Miciński J., Dymnicka M., Łozicki A., 2004: Wpływ wybranych czynników genetycznych i środowiskowych na cechy ilościowe i jakościowe nasienia buhajów ras mięsnych. *Zeszyty Naukowe Przeglądu Hodowlanego* 72 (1) 275-285;
7. Mroczek J.R., 2006: Ocena wybranych cech buhajów rasy simentalskiej. *Przegląd Hodowlany* 12, 12-14
8. Stenzel R., Kamieniecki K., 1993: Wpływ niektórych czynników na ilość i jakość nasienia buhajów użytkowanych w Stacjach Hodowli i Unasieniania Zwierząt. *Ann.UMCS Lublin* 10, 65-73.

Summary

The effect of season collection and breed of bull on some traits semen were examined. The investigation was carried out on the five beef breeds: Simmental (SM), Limousine (LM), Charolaise (CH), Piemontese (PI), Blonde d'Aquitaine (BD). The following parameters were evaluated in semen: volume of ejaculate (ml), concentration of spermatozoa in the ejaculate (thous./mm³), percentage of live sperm in the ejaculate (showing progressive motion) and morphology (%). Season and breed has an influence on volume, sperm concentration, sperm live and percentage of morphological defects in spermatozoa in ejaculates from bulls semen used for insemination.