Original paper

RELATIONSHIPS BETWEEN THE UTERUS HORNS LENGTH AND PUBERTY ATTAINTMENT IN GILTS

Žarković I.

University of Novi Sad, Faculty of Agriculture, Department of Animal Science, 21000, Novi Sad, Serbia
Corresponding author: ivan.zarkovic@stocarstvo.edu.rs

Abstract

Intensive pig production represents one of the basic requirements in order to fulfill conditions necessary to achieve the effective reproduction or to timely provide sufficient number of good pregnant gilts in order to replace and repair the sow herd base. Reproductive efficiency of gilts and the gilt management is one of the primary factors of a successful production of piglets. This efficiency, among other things, expresses the number of pregnant gilts, desirable genetic traits, body weight, age at first estrus, the status of sexual maturity, longevity and a good general health.

The aim of this study was to determine the correlation between length of uterus horns and the time of reaching puberty in gilts. The data used during the comparative analyses of morphological parameters were the length of uterus horns without weight, ligaments, cervices and ovaries. For the testing data 592 animals were used. The studies were conducted in warm and cool periods of the year. The animals were sacrificed at 210 days of age. On the basis of morphological structure of the ovary and the stage of sexual maturity the following has been determined: the animals before reaching puberty, animals with first and second estrus cycle.

It was determined that the gilts that have made a second estrus cycle have greater significant difference ($p<0.01$) in length of uterus horns (172.90cm) compared to others. The results show that the female fattening gilts in relation to breeding gilts had significantly greater ($p<0.01$) length of uterus horns (131.31cm). According to the studies based on the season a statistically significant ($p<0.01$) difference in the length of uterus horns was determined. In first and second estrus cycle the higher percent of animals that have reached puberty was achieved in breeding gilts (38.38 and 39.47%).

Key words: *gilts, puberty, uterus horns*

Introduction

Reproductive efficiency of gilts and the gilt management is one of the primary factors of a successful production of piglets. This efficiency, among other things, expresses the number of pregnant gilts, desirable genetic traits, body weight, age at first estrus, the status of sexual maturity, mating or conception in gilts which is associated with their subsequent reproductive performance, longevity and good general health.

In practice, the above mentioned condition is difficult to achieve. The reason for this can be seen as a result of the strong influence of paragenetic factors such as diet, season, contact with sexually mature boars, environmental conditions, stress factors, treatment with exogenous hormones and health (Stančić et al., 2003; Peltoniemi et al., 2005).

The main reason for the occurrence of prolonged anoestrus preinsemination was that that estrus was not detected even after 8 months of age (Tummaruk et al., 2007; Patterson et al., 2010; Stančić et al., 2010).

According to Tummaruk, Tantasuparuk and Kunavongkrit (2008), the age of puberty in gilts is usually defined as "the time of the first estrus and ovulation with a continuation of regular estrus cycles".

One of the most common problems present in modern pig production is a high percentage of culled sows, which is around 30% on our farms and up to 50% worldwide (Gagrčin et al., 2009). Most of the gilts and young sows were removed from herds due to reproductive failure (Engblom et al., 2007).

It has been demonstrated that gilts with a high growth rate attain puberty earlier than those with low growth rate (Young et al., 2008; Tummaruk et al., 2009).

Gilts with a delayed age at first mating (>260 days) have a shorter lifetime performance than gilts mated at a younger age. Gilts attaining puberty at a younger age also produce more piglets during the first 3 parities than those attaining puberty at an older age (Young et al., 2008).

Infertility in the summer and autumn months varies from farm to farm, field to region and year to year. Finally, what we are most interested in is to achieve maximum fertility and reproductive performance regardless of season or location (Holyoake et al., 2005). Infertility during the summer period covers a wide range of problems including anoestrus in gilts and sows, the problem with detection of estrus, conception and decreased level of embryo survival (Donald, 2007).

The aim of the present study was to determine that the length of uterus horns and the season affect the attaining puberty in gilts.

Material and methods

The aim of this study was to determine the correlation between the length of uterus horns and the time of reaching puberty in gilts. The data used during the comparative analyses of morphological parameters were the length of uterus horns without weight, ligaments, cervices and ovaries. Examination was made on a large farm in Vojvodina. For testing we used data of 592 gilts that were randomly assigned to four groups (two groups of female fattening gilts and two groups of breeding gilts). The testing was performed in both the warm (May-October) and cool (November-April) season.

The animals were sacrificed at an average of 210 days of age. After sacrifice the observation of the morphometric parameters of the gilts was made in the Laboratory in the Department of Animal Science at the University of Novi Sad. Breeding and female fattening gilts were kept under different housing and feeding regime. Based on the number of ovarian follicles and size all the animals were divided into three stages, namely: before reaching puberty (Pp), at first

estrus cycle (1E), or second estrus cycle (2E). The measurement was performed with the meter. The average values of the length of the uterus horns were expressed in centimeters. Descriptive statistics was performed using the software package Statistics 12th.

Results and discussion

It is very important to know the factors that affect the intensity of reproduction as well as the timely detection of estrus, insemination and the time of attaining puberty in gilts. To achieve these requirements it is of primary importance that breeding gilts achieve optimum age and weight, as well as the optimal ratio of muscle mass and fat body reserves, as at the time of attaining puberty and in the fertile time of insemination (Radović et al., 2007).

Table 1. *Distribution of stages of sexual maturity depending on season and category*

Stage of sexual maturity	(Cool season)				Warm season			
	Category							
	Breeding gilts		Female fattening gilts		Breeding gilts		Female fattening gilts	
	N	%	N	%	N	%	N	%
PP	22	28.95	181	75.74	46	46.46	129	72.47
1E	24	31.58	54	22.59	38	38.38	28	15.74
2E	30	39.47	4	1.67	15	15.16	21	11.79
Total	76	100	239	100	99	100	178	100
Total 592								

In Table 1 we can see that the highest percentage (75.74%) was in the female fattening gilts before reaching puberty in the cool season and the lowest (1.67%) in the second estrus cycle also in cool season. The highest percentage (38.38%) of gilts with one estrus cycle was in breeding gilts in the warm season in relation to the breeding gilts (39.47%) in the second estrus cycle in the cool season.

Similar results regarding the influence of seasonal photoperiod were given by Stančić et al., 1990. According to the study cited by Cotton, 2001, from 23 to 60% gilts attain puberty lower between June and September than in the period from October to May. In pigs, the seasonal influence on both fertility and production traits is well documented (Tummaruk et al., 2004; Tummaruk et al., 2010).

Furthermore, based on the fecal progesterone results, the proportion of gilts exhibiting first standing estrus without ovulation is more common during hot season compared to any other period (Tummaruk et al., 2007) which is in harmony with our study that shows that the percentage of gilts that reach first estrus was highest in warm period (38.38%) in breeding gilts.

In Table 2 we can see that the gilts that have made a second estrus cycle have greater significant difference ($p<0.01$) in length of uterus horns (172.90 cm) compared to the others. The results show that the female fattening gilts in relation to breeding gilts had significantly greater ($p<0.01$) length of uterus horns (131.31cm). According to the study based on the

season in cool and warm period of year a statistically significant ($p<0.01$) difference in the length of uterus horns was determined.

Table 2. *Average value and variability of the length of uterus horns*

	N	$\overline{X}$	SE	SD	CV	P
Category						
Breeding gilts	417	52.45	1.38	28.08	53.54	0.000**
Female Fattening gilts	175	130.31	4.55	59.97	46.02	
Seasons						
Cool	315	77.01	3.32	58.90	76.48	0.000**
Warm	277	73.52	2.82	46.90	63.79	
Stage of sexual maturity						
PP	377	47.18	1.00	21.36	45.25	0.000**
1E	145	101.78	2.80	33.59	33.01	
2E	70	172.90	7.82	65.47	37.86	
All population	**592**	**112.75**	**3.75**	**91.21**	**80.90**	

A morphometrical evaluation of the reproductive system of gilts before reaching sexual maturity could be a useful indicator for the estimation of early potential and actual fertility of sows (Kapelański et al., 2012).

Several experiments have suggested that uterine length influences uterine capacity (Wu et al., 1988; Chen and Dziuk., 1993; Wu and Dziuk., 1995). It has also been shown that gilts vary profoundly in the length of the uterine horns (Chen and Dziuk, 1993).

According to the research of the foreign authors the length of the uterus horns was 37 cm in gilts before reaching puberty and 244.1 cm in gilts that have reached first estrous cycle. This is in harmony with our research where the gilts before reaching puberty had 47.18 cm of the uterus horns to 101.78 cm at the time of reaching first estrus cycle. Between various races and crossbreds there are differences in the length of the uterus horns. For example, the length of uterus horns in China race Mainshan had a significantly lower length than the European white race Yorkshire. In addition, there are differences in the length of uterus horns between Swedish Landrace race (66cm) in comparison to race Mangulica (61cm). This is also shown in our research where we can see that the length of uterus horns is higher in the fattening gilts (130.31cm) compared to breeding gilts (52.45cm).

There is little research evidence that could clearly demonstrate the correlation between the length of the uterus horns before and after the attainment of sexual maturity and during pregnancy (Christenson et al., 1987; Wu and Dziuk, 1988). Furthermore, there is no research evidence that seasonal period affects the length of uterine horns which is in harmony with our research, but the length of uterus is the important feature that influence the uterus capacity.

Conclusion

Based on the results obtained in this work it can be concluded that the categories of female fattening gilts in relation to breeding gilts showed statistically significant difference in the length of uterus horns (131.31 cm compared to 52.45cm). Furthermore it can be seen from research that there was significant difference between the length of uterus horns observed by influence of season and also category that affected the length of uterus horns.

The highest percentage of animals which achieved puberty was in the first and second estrus cycle. Although our research shows that female fattening gilts have greater length of uterus in relation to breeding gilts the higher percentage of breeding gilts that reached puberty was in the first and second estrus cycle. From the aim of this work we can see that the length of uterus horns does not influence the puberty attainment in gilts.

References

1. Chen ZY and Dziuk PJ 1993. Influence of initial length of uterus per embryo and gestation stage on prenatal survival, development and sex ratio in the pig. J. Anim.Sci 71:7, 1895-1901.
2. Christenson RK, Leymaster HA and Young LD 1987. Justification of unilateral hysterectomy-ovariectomy as a model to evaluate uterine capacity in swine. J. Anim. Sci 65,738–744.
3. Cotton B 2001. Reproductive Development in Gilts. Manitoba Agriculture and Food (Livestock), May, 2001, pp.1-2.
4. Donald G Levis 2007. Designs to Reduce Seasonal Effects On Reproduction, National Hog Farmer. Retrived Jun 2 2014, from http://nationalhogfarmer.com/mag/farming_gestation_sow_housing.
5. Engblom L, Lundeheim N, Dalin A-M and Andersson K 2007. Sow removal in Swedish commercial herds. Livest. Sci. 106, 76–86.
6. Gagrčin M, Stančić I, Božić A, Stančić B, Anderson R and Hervey R 2009. Reproduktivna performansa nazimica na velikim vojvođanskim farmama, Veterinarski glasnik 63, 1-2, 77-86.
7. Holyoake T 2005. What do we know of pregnancy loss during seasons infertility? In 'Proceedings of the Australian Association of Pig Veterinarians'. Gold Coast, Australia, pp. 13–17.
8. Kapelanski W, Jankowiak H, Bocian M, Grajewska S, Dybata J and Zmudzinska A 2012. Morphometric characteristics of the reproductive system in polish large White and polish landrace gilts at 100 kg body Weight. J. Anim. Sci. 13, 45-53.
9. Patterson JL, Beltranena E and Foxcroft GR 2010. The effect of gilt age at first estrus and breeding on third estrus on sow body weight changes and long-term reproductive performance. J. Anim. Sci. 88, 2500–2513.
10. Peltoniemi OAT, Tast A, Virolainen JV, Karkamo V, Heinonen M and Andersson MA 2005. Night-time Melatonin Secretion and Seasonally Delayed Puberty in Gilts. Reprod. Dom. Anim. 40, 224-227.
11. Stančić B, Šolić R and Šahinović R 1990. Ciklična ovarijalna aktivnost peripubertetskih nazimica u zimskom i proletnjem periodu. Stočarstvo 44, 1-2, 41-50.
12. Stančić B, Kovčin S and Gagrčin M 2003. Nazimica za priplod – Fiziologija i tehnologija reprodukcije (monografija). Univerzitet u Novom Sadu, Poljoprivredni fakultet,39-48pp.

13. Stančić I, Gagrčin M, Jovičin M and Jovanović S 2010. Occurrence and practical solvent possibility of gilts preinsemination anestrus. Biotech. Anim. Husbandry 26, 1-2, 37-46.

14. Tummaruk P, Tantasuparuk W, Techakumphu M and Kunavongkrit A 2004. Effect of season and outdoor climate on litter size at birth in purebred Landrace and Yorkshire sows in Thailand. J. Vet. Med. Sci. 66, 477–482.

15. Tummaruk P, Tantasuparuk W, Techakumphu M and Kunavongkrit A 2007. Age, body weight and backfat thickness at first observed oestrus in crossbred Landrace×Yorkshire gilts, seasonal variations and their influence on their subsequent reproductive performance. Anim. Reprod. Sci. 99, 167–181.

16. Tummaruk P, Tantasuparuk W and Kunavongkrit A 2008. Age at puberty in landrace, yorkshire, duroc and crossbred Landrace x Yorkshire gilts kept in evaporative cooling system in a commercial herd in Thailand. In Proceedings of the 15th Congress of FAVA - OIE Joint Symposium on Emerging Diseases, Bangkok, Thailand, 4pp.

17. Tummaruk P, Tantasuparuk W, Techakumphu M and Kunavongkrit A 2009b. The association between growth rate, body weight, backfat thickness and age at first observed oestrus in crossbred Landrace×Yorkshire gilts. Anim. Reprod. Sci. 110, 108–122.

18. Tummaruk P, Tantasuparuk W, Techakumphu M and Kunavongkrit A 2010. Seasonal influence on the litter size at birth of pig are more pronounced in the gilt than sow litter. J. Agri. Sci. 148, 421–432.

19. Wu MC and D z i u k PJ 1988. Ovarian influence on uterine growth in prepubertal gilts. J. Anim. Sci. 66, 2893–2898.

20. Wu CM and Dziuk JP 1995. Relationship of lenght of uterus in prepubertal pigs and number of corpora lutea and fetuses at 30 days of gestation. Anim. Reprod. Sci. 38,327-336.

21. Young MG, Tokach MD, Aherne FX, Dritz SS, Goodband RD, Nelssen JL and Loughin TM 2008. Effect of space allowance during rearing and selection criteria on performance of gilts over three paities in a commercial swine production system. J. Anim. Sci. 86, 3181-3193.