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ANALYSIS OF REPRODUCTIVE PARAMETERS IN SOWS WITH REGARD TO THEIR HEALTH STATUS

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Abstract

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The aim of the study was to evaluate selected reproductive parameters in sows. Observed parameters were analysed in two herds with different health status. The experiment involved 160 hybrid sows from the 1st to the 5th litter (80 sows with health status A and 80 sows with health status B). Highly statistically significant differences ($P \leq 0.001$) and significant differences ($P \leq 0.05$) were found between the two groups in length of gravidity, total numbers of piglets, numbers of live-born piglets, numbers of stillborn piglets, numbers of reared piglets and losses of piglets per litter in favor of group B with declared health status. Evaluation of phenotypic correlation between the total number of piglets and the live-born piglets in the sows without declared health status revealed high positive correlation ($P \leq 0.01$). Strong positive dependence was found also between the live-born and the reared piglets in this group. In the sows with declared health status, high positive correlation ($P \leq 0.01$) was found also between the total number of piglets and the number of live-born piglets and between the number of live-born and reared piglets.

Keywords: sow, piglet, health, performance

INTRODUCTION

Breeding of sows is from the farming and economical aspects one of the most exhausting branches of pig breeding. The aim of breeding of sows is to produce piglets and to gain a profit. A prerequisite of effective breeding of sows is ensuring good health and high performance of sows characterized by a number of reared piglets per sow (Boudný and Špička, 2012; Horký *et al*., 2012; Horký *et al*., 2013). It is constantly pointed out, that particularly the number of reared piglets per sow is the cause of problems in Czech farms and also that there is a significant difference between our and succesfull foreign farms (Horký, 2014; Rozkot, 2012). Rodríguez *et al*. (2012) consider the number of reared piglets a major economic effect of breeding of sows. Optimal reproductive management is beside various endogenous and exogenous factors influenced by health condition, which is then reflected in rearing and fattening of pigs and therefore in whole profitability of a farm. Poor health situation in herds negatively influences the farm economy (Lambert *et al*., 2012). Zhao *et al*. (2012) say that it is beyond a doubt, that the main problem are viral diseases such as virus of porcine respiratory and reproductive syndrom (PRRS) and porcine circovirus 2 (PCV-2) and remark that it is due to completely open pig market at the international level. Epidemiological situation in the Czech Republic is not different from the situations in other countries of the European Union. Holtkamp *et al*. (2012) say that underestimation of PRRS, as a very important disease significantly decreasing the level of health condition in porcine population, is the most likely reason of massive spread of infection to most productive, reproductive

and breeding farms. PRRS virus undisturbedly spreaded in porcine population from the top of breeding pyramide to its base. Insufficient attention followed by absence of necessary provisions led to hard devaluation of health condition in pig herds presented as infection of PRRS virus. As stated by Laanen *et al.* (2013), an important way of creating and maintaning profitable economic level of a farm is establishing pig herds without occurence of economically important diseases by the method of repopulation. According to Nevrkla *et al.* (2013), the disease life cycle can be interrupted this way as there is no contact between piglets and sows. This method is known as status with minimal disease (MD). The method is economically more demanding than conventional rearing of piglets by sows. Therefore it is recommended for production of pigs in breeding or reproductive farms. In productive farms, the sows give birth naturally (Jorsal and Thomsen, 1988). It is necessary to follow the rules of biosecurity to prevent reinfection in a repopulated farm (Laanen *et al.* 2013). Jorsal and Thomsen (1988) state, that the method or repopulation and creating MD herds should have a positive effect on reproductive performance of sows, piglet losses reduction, improvement of productive parametres in pigs, improvement of health situation in herds and therefore reduction of treatment costs.

The aim of the study was to evaluate selected reproductive parameters and analyse their correlations in sows. The observed parameters were evaluated in two herds with different health status.

MATERIAL AND METHODS

The experiment involved 160 hybrid sows from the 1st to the 5th litter (80 with health status A and 80 with health status B).

Health status A: In this group of sows, analysis of blood samples detected porcine respiratory and reproductive syndrom (PRRS) and porcine circovirus (PCV-2). The rules of biosecurity were not applied in the stable.

Health status B: Newly delivered sows were placed into decontaminated stable with strict batch, black and white breeding system with stringent hygienic provisions. Blood samples were taken from all sows and they were confirmed to be free of following diseases: Aujezsky's disease (AD), enzootic pneumonia (EP), classical swine fever (CSF), porcine circovirus (PCV-2), pleuropneumonia (P), porcine respiratory and reproductive syndrom (PRRS), porcine parvovirus (PPV), brucellosis (BA) and dysenteria (D).

In the category of inseminated sows, animals were stabled individually from the onset of estrus to the detection of pregnancy for approximately one month. The pregnant animals were subsequently moved into static group pens for 15 to 20 pieces. The gilts were provided with transponders for their identification and allocation of feed rations at the feed station. In these pens they stayed until an average of five days before giving birth. In the category of advanced stage of pregnancy, farrowing and lactating, the animals were stabled in individual farrowing pens with slatted plastic floors and the farrowing house was devided into sections. All the above mentioned categories were fed by automatic distribution of feed. Air exchange both in farrowing section and in section of inseminated and pregnant animals was solved by automatic methods. Optimal microclimate for piglets was ensured using heated plates, supplementary feeding followed from the fifth day after birth. The piglets were weaned at the mean age of 28 ± 3 days. In both groups of sows (status A, B) phenotypic levels of selected reproductive parametres were observed, namely the total number of born piglets, the number of live-born piglets, the number of stillborn piglets, the number of reared piglets and the losses of piglets from birth to weaning.

The obtained values of reproductive paramteres and the losses of piglets in the health status A were compared to the values of the parametres obtained for health status B and basic statistical characteristics for differences in evaluated parametres between the groups of sows were analyzed, namely mean, standard deviation, coefficient of variation, maximum and minimum values and statistical significance based on the t-test. The symbol *** stands for $P \leq 0.001$, ** stands for $P \leq 0.01$, * stands for $P \leq 0.05$ a NS stands for $P \geq 0.05$. Also correlation of evaluated reproductive parameters was analysed according to the Pearson's correlation coefficient. The data were analysed using software QC expert (TriloByte Statistical Software Ltd.).

RESULTS AND DISCUSSION

The good health status of sows led to an increase of reproductive performance. Tab. I presents gestation length, total numbers of piglets, numbers of live-born, stillborn and reared piglets per litter from sows with different health status. Highly statistically significant difference ($P \leq 0.001$) and significant difference ($P \leq 0.05$) was found betweeen the evaluated parameters in favor of sows in the group B with declared health status. Namely the length of gestation was 1.59 day longer in sows of the group B. The total number of piglets increased by 2.61 piglets, the number of live-born piglets by 3.28 piglets, the number of stillborn piglets per litter decreased by 0.67 piglet and the number of reared piglets recorded an increase by 4.11 piglets.

Olanratmanee *et al.* (2010) report 12.10 born piglets per litter from sows in good hygienic conditions against 11.70 from sows in poor hygienic conditions, which indicates the need for breeding sows in good health status. Lewis *et al.* (2009) state that PRRS virus influences reproductive performance of sows and gilts. Their results show that healthy gilts in the first litter had over 9 live-born piglets compared to only 7 live-born piglets in gilts with health issues and note that this parameter is also dependent

on the genetics of animals. This is confirmed by Smith *et al.* (2008) who found following numbers of live-born piglets from Dandbred sows in normal breeding conditions: in the first litter 9.80, in the second litter 10.10, in the third litter 9.50 and in the fourth litter 11.00. Nielsena *et al.* (2002) reported 2 to 6 stillborn piglets per litter from sows with health problems. Lewis *et al.* (2009) found 3.00 stillborn piglets from ill gilts and 0.60 stillborn piglet from healthy sows per litter. The number of reared piglets is considered the most important effect of breednig of sows. Lewis *et al.* (2009) reported 7.50 reared piglets per litter from sows with health problems against 9.25 reared piglets per litter from healthy sows. Nevrkla *et al.* (2013) found 9.68 ± 1.75 reared piglets before repopulation and more than 13 after repopulation.

Fig. 1 shows losses of piglets from birth to weaning per litter. In the health status A the losses counted 2.05 ± 1.43 piglets against 1.18 ± 1.44 piglet in health status B. The difference between the evaluated groups of sows was 0.87 piglet, which is a highly statistically significant difference ($P \leq 0.001$) in favor of the group B.

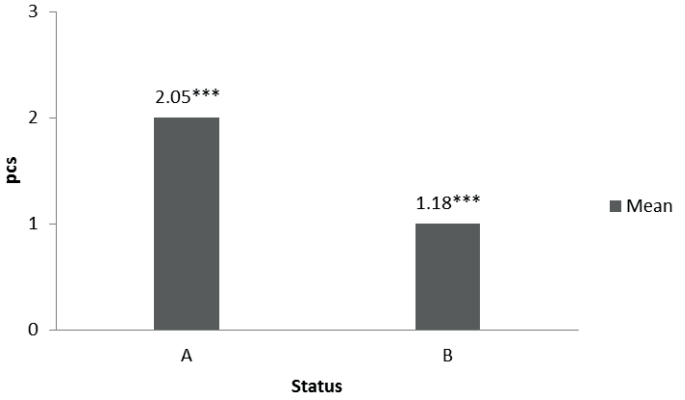
Vaillancourt *et al.* (1992) say that the intensive production of sows is accompanied by certain critical phases. Loss of piglets from birth to weaning is considered an important one, either as a result of infectious diseases or nonpathogenic causes, therefore monitoring of piglets allows its optimization. Munsterhjelm *et al.* (2006), Andersen *et al.* (2009) and Oliviero *et al.* (2010) state that appropriate health programs in herds of sows minimize the losses of piglets after birth. According to Rootwelt *et al.* (2012) the loss of piglets from birth to weaning in problematic herds reaches 16.20%. Roehe and Kalm (2000) highlight that the highest losses of piglets are recorded during the first week of life, which is confirmed by Arango *et al.* (2006). They add that the loss during the first day is around 4%. The second day after birth, the mortaliy is the highest up to 17% and the following days it declines. The third day it is 16%, the fourth day 9% and the fifth day 7%. From the sixth day, the mortality is stabilized at 4%.

Tab. II displays correlations between individual reproductive parameters in sows without declared health status. High positive correlation ($r = 0.771$) evaluated as highly statistically significant ($P \leq 0.01$) was found between the total number of born piglets and the number of live-born piglets. Between the total number of piglets and the number of stillborn

I: *Basic statistical characteristics of selected reproductive parametres in sows with or without declared health status*

Parameter	Status	Mean	S_x	V_x	Min	Max	t test
Gestation length (days)	A	115.31	1.48	1.28	113	119	***
	B	116.90	3.62	3.08	114	147	
Total number of piglets/litter	A	13.33	2.40	18.00	5	19	***
	B	15.94	2.46	15.43	11	23	
Number of live-born piglets/litter	A	11.45	2.13	18.60	4	17	***
	B	14.73	2.25	15.27	11	21	
Number of stillborn piglets/litter	A	1.88	1.55	82.87	0	6	**
	B	1.21	1.53	126.34	0	8	
Number of reared piglets/litter	A	9.44	1.78	18.86	4	12	***
	B	13.55	1.99	14.69	10	18	

A – without declared health status; B – with declared health status; *** ($P \leq 0.001$); ** ($P \leq 0.01$)



1: *Losess of piglets from birth to weaning by the health status (pcs/litter)*
A – without declared health status; B – with declared health status;
*** ($P \leq 0.001$)

II: *Correlation analysis of dependences between reproductive parameters in sows without declared health status*

Parameter	Total number of piglets/litter	Number of live-born piglets/litter	Number of stillborn piglets/litter	Number of reared piglets/litter	Losses of piglets/litter
Gestation length (days)	–0.147^{NS}	–0.065^{NS}	–0.137^{NS}	–0.144^{NS}	0.088^{NS}
Total number of piglets/litter		0.771**	0.484*	0.400^{NS}	0.656**
Number of live-born piglets/litter			–0.185^{NS}	0.752**	0.560*
Number of stillborn piglets/litter				–0.415^{NS}	0.242^{NS}
Number of reared piglets/litter					–0.113^{NS}

NS P ≥ 0.05; * (P ≤ 0.05); ** (P ≤ 0.01)

III: *Correlation analysis of dependences between reproductive parameters in sows with declared health status*

Parameter	Total number of piglets/litter	Number of live-born piglets/litter	Number of stillborn piglets/litter	Number of reared piglets/litter	Losses of piglets/litter
Gestation length (days)	0.104^{NS}	0.205^{NS}	–0.133^{NS}	0.132^{NS}	0.137^{NS}
Total number of piglets/litter		0.792**	0.443*	0.545*	0.482*
Number of live-born piglets/litter			–0.196^{NS}	0.779**	0.484*
Number of stillborn piglets/litter				–0.266^{NS}	0.063^{NS}
Number of reared piglets/litter					–0.175^{NS}

NS (P ≥ 0.05); * (P ≤ 0.05); ** (P ≤ 0.01)

piglets, the correlation (r = 0.484) was moderate and statistically significant (P ≤ 0.05). Medium correlation dependence (r = 0.656) with high statistical significance (P ≤ 0.01) was recorded between the total number of piglets and the losses of piglets from birth to weaning. Strong positive correlation (r = 0.752) with high statistical significance (P ≤ 0.01) was found between the live-born and the reared piglets. Moderate positive correlation (r = 0.560) was also observed between the number of live-born piglets and the losses of piglets and the dependence was statistically significant (P ≤ 0.05). Analysis of correlation between the other parameters revealed no statistically significant dependences.

Tab. III shows correlation analysis of reproductive parameters in sows with declared health status. The evaluation of phenotypic correlations between the total number of piglets and the number of live-born piglets proved high positive dependence (r = 0.792, P ≤ 0.01). Moderate positive correlations were observed between the total number of piglets and the number of stillborn piglets (r = 0.443, P ≤ 0.05) and between the total number of piglets and the losses of piglets (r = 0.482, P ≤ 0.05). The same statistical significance (P ≤ 0.05), but medium correlation (r = 0.545) characterized the dependence between the total number of piglets and the number of reared piglets. The numbers of live-born and reared piglets showed high positive correlation (r = 0.779, P ≤ 0.01) and the numbers of live-born piglets and the losses of piglets moderate positive correlation (r = 0.484, P ≤ 0.05). No statistically significant dependence was found between the other parameters.

Rydhmer *et al.* (2008) found negative correlation between the length of gravidity and the losses of piglets after birth. Olanratmanee *et al.* (2010) described highly significant correlation between the total number of piglets and the number of live-born piglets. Škorjanc *et al.* (2007) reported positive correlation (r = 0.815) with highly statistically significant dependence (P ≤ 0.01) between the number of live-born piglets and the number of reared piglets.

CONCLUSION

Highly significant differences (P ≤ 0.001) and significant differences (P ≤ 0.05) were found between the evaluated reproductive parameters, namely the gestation length, the total number of piglets, the numbers of live-born, stillborn and reared piglets and the losses of piglets per litter, in favor of the sows in the group B with declared health status. The evaluation of phenotypic correlations between the

total number of piglets and the number of live-born piglets per litter in sows without declared health status proved high positive correlation ($r = 0.792$, $P \leq 0.01$). Strong positive dependence ($r = 0.752$) was observed also between the live-born and the reared piglets. In sows with declared health status, strong positive correlation was proved between the total number of piglets and the number of live-born piglets ($r = 0.792$, $P \leq 0.01$) and between the numbers of live-born and reared piglets ($r = 0.779$, $P \leq 0.01$). The values of selected reproductive parameters found in the group of sows with declared health status can be described as competitive, which indicates that good health status of sows improves their reproductive performance.

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