

INVESTIGATIONS ON EMBRYONIC AND FETAL LOSSES OF PIGLETS OF GERMAN LAND-RACE SOWS

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Abstract

A high number of live born and especially vital piglets is the basis for an efficient piglet production. In an experiment the amount of embryonic and fetal losses in German Landrace sows was investigated. To achieve an optimal number of piglets it is necessary to make use of the high potential in fertility. The difference between the number of ovulated oocytes and the number of live born piglets is an indicator of the degree of the use of this potential. The experiment was conducted in a pig breeding farm on three dates of biological relevance, on day three of gestation (number of ovulated oocytes), on day 30 of gestation (end of embryonic development) and on day 80 of gestation (end of fetal development). At all 93 gilts have been used. The following aspects have been detected: number of ovulated oocytes, number of corpora lutea, number, length and weight of embryos and fetuses, length and weight of ovary and uterus. At day 3 of gestation only 56.4% of detected oocytes are fertilized and intact. As a result the amount of embryonic losses at day 30 of gestations is 36.9%. The amount of fetal losses is less than 1%. The number of corpora lutea has an influence on the amount of embryonic losses. If there are more than 24 corpora lutea, the amount of embryonic losses rises up to 63%. In contrast, the fetal losses are not increased. The results of this experiment show, that there is still a high potential in fertility that should be used.

Key Words: Embryonic losses, fetal losses, survival rate, piglet

Live born and especially vital piglets are the starting point for an efficient piglet production. In an experiment the amount of embryonic and fetal losses in German Landrace sows was investigated. It is necessary to exploit the given genetic potential to realize an optimal number of vital piglets. The degree of usage of this potential can be calculated. The difference between the number of ovulated oocytes and the number of live born piglets should be small. The reduction from the potential to the realized fertility may have diverse reasons, e.g. fertilization rate, amount of embryonic and fetal losses as well as losses in the perinatal period.

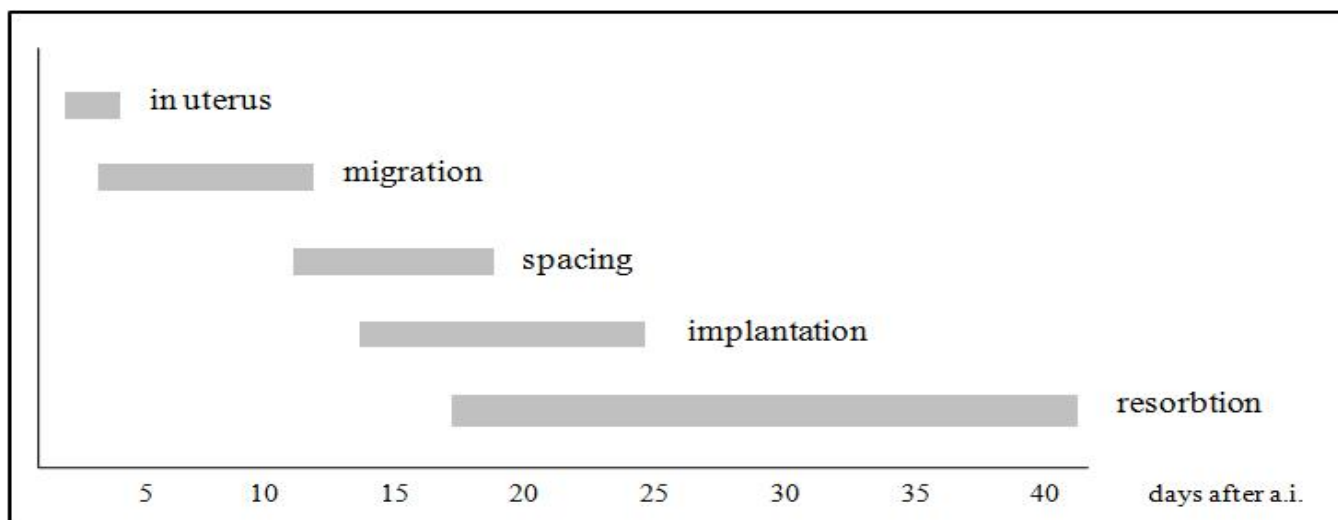
Within the first three weeks of a pregnancy most of the losses occur. In literature the amount of embryonic losses varies between 20 and 50 % of fertilized oocytes (POPE AND FIRST, 1985). The time to successful implantation is very sensitive. After artificial insemination the fertilized oocytes migrate from the oviduct through the uterus horns. They may move from one horn to the other and distribute themselves equally. If a relevant part of about 30 % of one uterine horn stays unoccupied by fertilized oocytes the gestation may be stopped. Figure 1 shows the relevant periods of early gestation. In general losses of 30 % are seen as a biological caused portion (KOLB, 1980; LUTTER et al., 1981; POPE and FIRST, 1985). It is

necessary to adopt litter size to the environmental conditions and to reduce the number of embryos to a level, which can be supported with nutrients until the end of pregnancy (EDWARDS, 2002).

Another crucial factor is the capacity of the uterus. In large part this feature is genetically determined. If the uterine space is too small it can lead to a reduced survival rate of embryos or an interruption of the gestation at all (LEGAULT, 1998; VALLET and FREKING, 2006). Losses until the 30th day of gestation are defined as embryonic losses; dead fetuses from day 30 until day 80 of gestation are defined as fetal losses (ASHWORTH, 1998). Fetal losses are about 2-5% (LAMBERT et al., 1991).

Material and Methods

The experiment was conducted in a pig breeding farm on three dates of biological relevance, on day three of gestation (number of ovulated oocytes), on day 30 of gestation (end of embryonic development) and on day 80 of gestation (end of fetal development). At all 93 gilts have been used (Table 1).

Figure 1. Relevant periods of early gestation**Table 1. Experimental design for investigation on embryonic and fetal losses**

part of experiment	day of gestation	number of gilts (no.)	investigated parameter
I	day 3	29	fertilisation rate
II	day 30	34	embryonic losses
III	day 80	30	fetal losses

The gilts have been synchronized in ovulation. At the age of 220 days the gilts got Regumate® for the duration of 15 days. 24 hours after the last application of Regumate® an injection of 1000IE PMSG was given. 56 hours later an injection of 50µg Gonavet® followed. The artificial insemination was performed twice time orientated.

The gilts of part I of investigation have been ovariectomised. The oviducts and a subsequent part of 10 cm length of the uterine horn have been rinsed to analyse the number of fertilized oocytes. Gilts of part II and III have been slaughtered. The following aspects have been analyzed:

- number of ovulated oocytes,
- number of corpora lutea (c.l.),
- number, length and weight of embryos and fetuses,
- length and weight of ovary and uterus
- tissue samples of locations of implantation and beside on day 30 and 80.

The number of corpora lutea indicates the potential of piglets. At day 30 of gestation the difference between the number of c.l. and the number of detected embryos reflects the amount of embryonic losses. The calculation

of fetal losses is done by the difference of losses at day 80 (difference of number of c.l. and number of fetuses) and day 30 of gestation.

Results

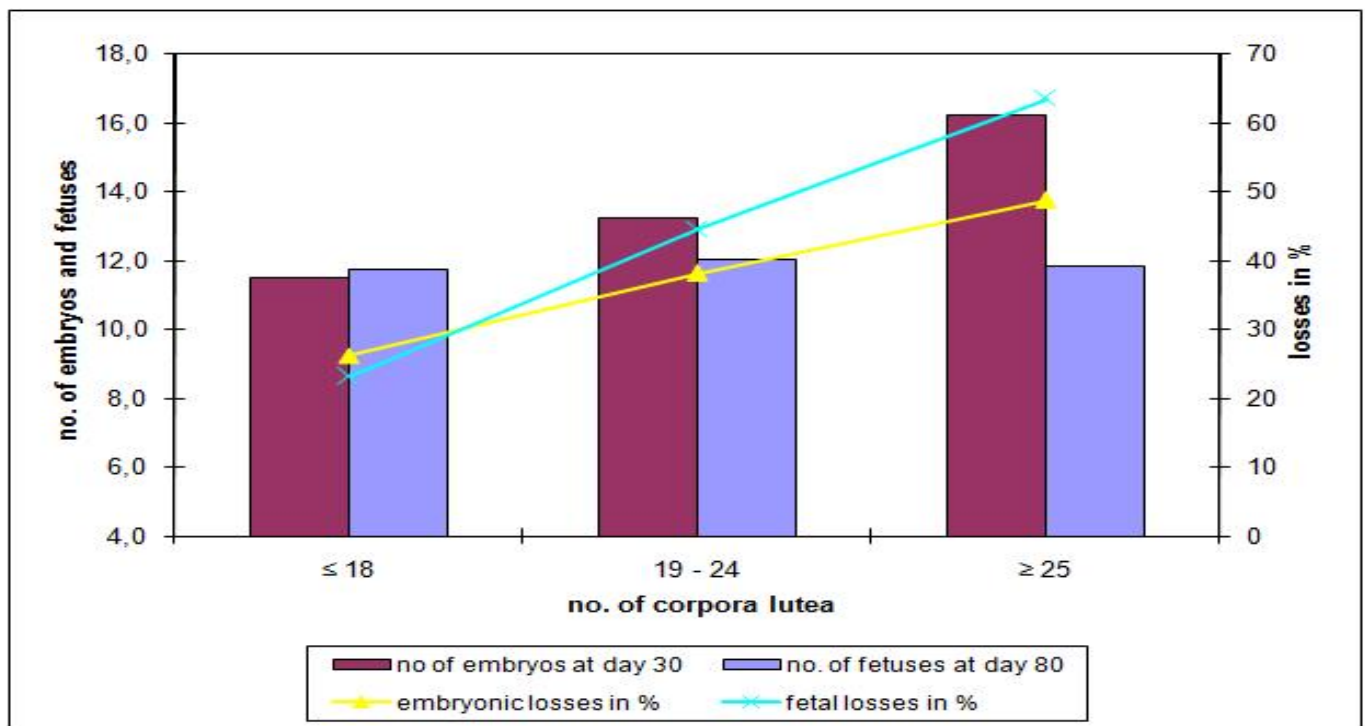
At day 3 of gestation only 56.4% of detected oocytes are fertilized and intact. As a result the amount of embryonic losses at day 30 of gestations is 36.9%. The amount of fetal losses is less than 1%. Taking into account that at day 2 only about 63 % of all oocytes could be detected under the microscope, the amount of losses is comparable with the amount of embryonic losses. The results are shown in Table 2.

The number of corpora lutea has been analysed. An influence could be detected on the amount of embryonic losses. If there are more than 24 corpora lutea, the amount of embryonic losses rises up to 63%. In contrast, the fetal losses are not increased. These results are illustrated in Figure 2.

With a view to the number of fetuses and the amount of losses of about 40 % the best results have been achieved in the group of 19 – 24 corpora lutea.

Table 2. Results of the investigation on embryonic and fetal losses

part of experiment	I (day 3)	II (day 30)	III (day 80)
no. of gilts	29	34	30
no. corpora lutea	12.9 ± 5.1	22.8 ± 8.8	20.5 ± 6.6
no. embryos / fetuses	8.0 ± 4.6	17.0 ± 4.5	12.3 ± 3.6
<i>intact</i>	5.7 ± 4.9	13.5 ± 4.3	11.8 ± 3.6
embryonic/fetal losses % (1- [fetus intact / no. c.l.])	56.4 ± 23.5	36.9 ± 20.0	37.7 ± 24.2

Figure 2: Number of embryos and fetuses and the amount of losses in % according to the number of corpora lutea

Discussion

The results of this experiment show, that there is still a high potential in fertility of the modern breed of German Landrace sows. The amount of losses, the embryonic as well as the fetal ones, prove results from literature (VAN DER LENDE et al., 2001). According to the number of corpora lutea experiments of WU et al. (1989) confirm these results also. WAEHNER (1989) as well as GEISERT and SCHMITT (2002) stress the correlation of the number of c.l. and the rising amount of losses.

In consequence these data are the basis for further investigations in selected family structures in order to

identify genomic variants, which could have an influence on litter size and number of vital piglets. In addition the results emphasize the meaning of scientific research in the cross talk between embryo and sow and potential impact factors on the amount of losses during pregnancy. The tissue samples of locations of implantation and beside from day 30 and day 80 will get analysed in proteomics and genomics.

These results are important for applied sciences as well as for the working farmer. Despite that equivalent housing and feeding conditions are still required to achieve high numbers of live born and vital piglets.

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