PRELIMINARY RESULTS
ON ULTRASOUND EXAMINATIONS OF PIG OVARIES
DURING POST-WEANING PERIOD

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Abstract

The aim of the study was to evaluate the usefulness of ultrasound examination in determining the dynamics of ovarian follicular growth, estimating the time of ovulation, and diagnosing the pathological state of the ovary in the period after weaning. The examinations were conducted under commercial farm conditions on primiparous (n=20) and multiparous sows (n=20). In the experiment, a Scanner 200 and a linear 5-MHz probe were used. The sows were examined by a non-invasive transcutaneous method. In about 20% of the females, the presence of small (1-2 mm) ovarian follicles was observed on the day of weaning, whereas in the majority of animals these ovarian structures were not detected. It was shown that in most animals the dynamics of follicular growth on the days following weaning differed only slightly between the two groups and oestrus occurred on days 4-5. At the beginning of oestrus, the average size of ovarian follicles in the multiparous sows was 5.23 ±1.36 mm and was larger than that observed in the primiparous sows (3.42 ±1.87 mm, P<0.01). It was also observed that in the group of the multiparous sows, the maximum diameter of the follicles prior to ovulation, amounting to 7.81 ±1.26 mm, was larger than in the primiparous sows (6.06 ±1.77 mm, P<0.01). The time of ovulation in both groups of animals was typical and fell on the third day of oestrus. During the examinations, one case of a single ovarian cyst and one case of multiple cysts were detected, which amounted, in total, to 4.5% of the animals examined. Ovarian afunction (lack of follicles) was observed in another 4.5% of the sows in this experiment. This study confirmed the usefulness of transcutaneous ultrasound imaging of pig ovaries for the evaluation of their physiological and pathological conditions.

Key words: sows, ovary, post-weaning period, ultrasonography.

The optimum breeding of pigs under farm conditions is related to oestrous cycles following weaning. The return of the ovaries to their cyclical function after pregnancy and lactation is often accompanied by a number of disorders, which is a significant cause of lowered fertility in many herds (8, 12). The methods routinely used for oestrus detection and evaluation are increasingly insufficient. This generates a need to implement new methods to observe ovarian activity during this period.

Recently developed ultrasound monitoring of the gonads makes possible the evaluation of the development of ovarian follicles in the post-weaning period, the determination of the time of ovulation, and the diagnosis of ovarian disorders (1, 2, 4). The application of this method as an ovarian diagnostic tool for practitioners is still in its infancy. Information on this subject has not been plentiful so far (4-6), while in the Polish literature there is a complete lack of reports evaluating ultrasound ovarian examinations in pigs.

The aim of the study was to evaluate under field conditions the usefulness of ultrasound examinations in determining the dynamics of the growth of ovarian follicles, estimating the time of ovulation, and diagnosing the pathological states of the ovaries in the period after weaning.

Material and Methods

The animals used, and an outline of the experiment. The examination was conducted on a total of 40 females, divided into two equal groups comprising primiparous sows and multiparous sows. The animals belonged to a herd consisting of 350 sows and the whole experiment was carried out under commercial farm conditions.

The monitoring of the ovarian function began on the day the piglets were weaned, and continued, depending on the appearance of oestrus and ovulation, until day 5 to 9 afterwards. The examinations were conducted twice a day (6°0-8°0 and 18°0-20°0). In total, 600 examinations were carried out; the results were recorded in the form of ultrasound pictures.

The detection of oestrus and the times of insemination of the females were part of a routine
breeding programme carried out on the farm. On the basis of ultrasound monitoring, as well as clinical examinations and observations, the following indices for each subgroup were calculated: the length of oestrus, the time of ovulation, the weaning-to-oestrus interval and the weaning-to-ovulation interval. Data were analysed by using the Student-\(t\) test.

**Ultrasound examination.** Ultrasound examinations of the ovaries were conducted using the transcutaneous method. They involved placing a probe in the right side of the animal abdomen, at a distance of 20-30 cm above the mammary ridge, with the head of the probe being directed towards the left shoulder joint. The gonads were situated at the front end of the bladder, at a depth of about 3-7 cm from the abdominal wall, between the loops of the uterine horns. A more precise description of the transcutaneous examination technique was presented in an earlier review paper published by the authors (13).

A portable cable Scanner 200 (Pie Medical, the Netherlands) with a linear 5-MHz probe was used. The apparatus allowed examinations to be performed for several hours, and had freeze and image-size regulation functions. A Mitsubishi P93 printer, together with a cable remote control, was also included in the equipment, to enable the collection of documentation in the form of ultrasound pictures.

In the ultrasound examination, the following parameters were determined:
- the presence, size, and shape of the ovarian follicles (measured in millimetres)
- the time of ovulation – its occurrence was considered to be the moment half-way between two consecutive examinations, in the first of which a dominant ovarian follicle was visible, while in the second it became invisible (3, 6, 8).
- the prevalence of ovarian abnormalities such as cysts, atrophy, and others.

Ovarian cysts (luteal, follicular, mixed, or cystic degeneration) were diagnosed taking into consideration their diameter, echogenicity, wall thickness, their possible regression, and the presence of a cycle (7, 8). Single or multiple follicular-like structures exceeding the size of 11 mm in animals not exhibiting a cycle were generally regarded as cysts.

During the observation, the lack, or a permanent presence of small ovarian follicles of a size no larger than 4-5 mm was considered as ovarian atrophy (8).

**Results and Discussion**

The ultrasound examination technique used in the present study made possible the imaging of the ovaries in all the animals examined (Figs 1, 2), although left ovaries proved to be more difficult to detect both in multiparous and primiparous sows. These difficulties resulted from the use of the transcutaneous ultrasound method; other authors mentioned similar problems (4, 6, 8). However, it is necessary to stress the practicality of the method applied, as the transcutaneous examination is less invasive, lasts less time, and provides easy access to a placement site for the probe head. In contrast to another examination technique – the rectal method – these are advantages, which enable its use under commercial farm conditions without disturbing the daily rhythm of work. An additional benefit is the reduction of the infectious diseases risk, which is of great importance in pig breeding (1, 5, 7). It is also significant that this method enabled the imaging of ovaries in young females of smaller body mass.

**Fig. 1.** Pig ovary at onset of oestrus with follicles visible as black spots, follicular diameter 3.6 mm. Ultrasound images with 5 MHz linear probe.

**Fig. 2.** Pig ovary with pre-ovulatory follicles, diameter 11 mm. Ultrasound images with 5 MHz linear probe.

The dynamics of ovarian follicular growth and the estimation of the time of ovulation. In about 20% of the females, the presence of small (1-2 mm) ovarian follicles was observed on weaning day, while in the majority of them the ultrasound picture of the ovary was homogeneous, with no presence of areas of low echogenicity characteristic of follicles. In the latter part of the post-weaning period, a slight difference was observed in the time of the appearance of detectable follicles in both subgroups of the animals. In
Multiparous sows, in general, it took place on days 2-3 after weaning, whereas in primiparous sows it was slightly later, i.e. on days 3-4. The dynamics of follicular growth on the days following weaning differed only slightly between the two groups, though individual characteristics appeared in certain animals. In both age groups, oestrus appeared, on average, 4-5 d after weaning of piglets; however, in multiparous sows the onset of oestrus took place, on average, after 101.4 (± 16.7) h, whereas in primiparous sows it occurred after 96 (±8.59) h, (Table 1). However, in this period differences were observed between the sizes of follicles in primiparous and multiparous sows. The average cross-section of ovarian follicles in multiparous sows was 5.23 ±1.36 mm, and was larger than that observed in primiparous sows (3.42±1.87 mm, Table 1). This difference, was statistically significant (P<0.01). The occurrence of different sizes of follicles has also been described by other researchers; its cause was determined to be the stronger influence of primiparous sows’ post-weaning stress resulting in disorders in the functioning of the hypothalamo-pituitary axis and gonadotrophin secretion (9, 10, 11). It should, however, be added that these disorders were not deep and had a transient character, since oestrus and ovulation in this group of animals took place at the expected time. The observed sizes of follicles were not much different from those in the data published by Waberski et al. (14, 15) according to which the diameter of follicles on the first day of oestrus was between 5 and 8 mm.

In the present study it was also shown that in the group of multiparous sows the maximum diameter of follicles prior to ovulation (7.81 ±1.26 mm) was larger than in the primiparous sows (6.06 ±1.77 mm, Table 1), and the difference was statistically significant (P<0.01). In the research on ovulation conducted by Langendijk et al. (9) and Kauffold et al. (4), the cross-section of preovulatory follicles was, on average, 7-8 mm, while in the study by Waberski et al. (14) it amounted to 8-10 mm. The slight divergence in the size of follicles observed in the present study in relation to results obtained by other authors can be attributed to differences in breeds of the pigs examined, the fodder used, and to the breeding management systems specific to each farm.

An important aspect in each farm’s reproduction strategy is the estimation of insemination times resulting from the timing of ovulation in oestrus (6, 12, 14, 16). In our study, the time of ovulation in both groups of animals was typical and occurred on the third day of oestrus, though the differences shown between the groups were trivial and statistically irrelevant. In the multiparous sows, ovulation took place after 53.4±7.2 h of oestrus, whereas in the primiparous sows it occurred after 51.6±11.4 h (Table 1). In the research by other authors, different ovulation times were noted, falling between the 35th and 45th h of oestrus (10, 12, 16). However, it is well known that many factors can influence the wide variability, which characterises ovulations and their timing (4, 8).

Pathological structures of the ovary. The ultrasound examination of the gonads also made possible the detection of certain pathological structures of the ovaries such as various forms of cystic degeneration and ovarian afunction. In total, these states were noted in about 9% of the animals examined. Diagnosing the pathological structures of the ovaries is considered an important advantage of ultrasound evaluation of the organs after weaning (2, 5). Ovarian cysts were diagnosed as follicle-like structures of low echogenicity and their diameter was larger than 11 mm. The majority of authors agree that a pathological ovarian follicle with a diameter exceeding 11 mm should be regarded as an ovarian cyst (11, 15, 16). During our examinations, only one case of a single ovarian cyst and one case of multiple cystic degeneration was detected (4.5%). Cystic degeneration of pigs’ ovaries occurs with differing frequency in herds, ranging from 7.6% to 30% of the animals examined in several studies (4, 5, 15). On the other hand, in studies based on slaughterhouse material, cystic degeneration of the ovaries was present in 15-20% of females (14).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Multiparous sows (n=20)</th>
<th>Primiparous sows (n=20)</th>
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</thead>
<tbody>
<tr>
<td>Weaning to oestrus interval (h)</td>
<td>101.4±(16.7)</td>
<td>96.6 ±(2.6)</td>
</tr>
<tr>
<td>Oestrus duration (h)</td>
<td>73.8±(4.3)</td>
<td>75.6 ±(8.7)</td>
</tr>
<tr>
<td>Follicle diameter at onset of oestrus (mm)</td>
<td>5.2(±1.3)a</td>
<td>3.4 ±(1.8)</td>
</tr>
<tr>
<td>Oestrus to ovulation interval (h)</td>
<td>53.4±(7.2)</td>
<td>51.6 ±(11.4)</td>
</tr>
<tr>
<td>Diameter of pre-ovulatory follicles (mm)</td>
<td>7.8(±1.26)b</td>
<td>6.05 ±(1.7)</td>
</tr>
<tr>
<td>Weaning to ovulation interval (h)</td>
<td>154.8±(20.3)</td>
<td>147 ±(8.5)</td>
</tr>
</tbody>
</table>

Values with different superscripts are different \(^{a,b}\) P<0.01
Equally, an important problem in the post-weaning period is the lack of ovarian activity (2, 11). In the ultrasound images, the lack of ovarian function was characterised by the constant presence of small ovarian follicles of a size no larger than 2-3 mm, or by a complete lack of visible follicles. It should be added that, with the lack of follicular growth, the ovaries were difficult to detect because of the similar echogenicity of the stroma structure of the ovary and surrounding organic tissues. Other authors have also drawn attention to this problem (11, 12). The disturbed development of follicles had consequences in the lack of oestrus and ovulation. In the present study, this phenomenon was observed in about 5% of the females (2 multiparous sows). The occurrence of this form of ovarian disorder is related to no return of the ovaries to their physiological activity, caused by the prolonged inhibition of the secretory function of the hypothalamus and pituitary gland after the period of lactational anoestrus (2, 11, 16).

The factors stimulating the occurrence of this situation in sows are the poor health status, incorrect nutrition, stress, advanced age, incorrect temperature, air humidity, lighting, and lack of stimulation by a boar (9, 16).

The results obtained in the present study confirmed the possibility of ultrasound imaging of pigs’ ovaries and the evaluation of their condition. This was achieved with all the specimens examined using a relatively simple transcutaneous examination technique performed every 12 h, capable of being applied under farm conditions.

References