Development of the Accessory Genital Glands in Meishan Boars

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Abstract The developmental process of the seminal vesicle, corpus prostatae and bulbourethral gland was morphologically and histologically investigated in Meishan boars after birth. All of the glands remarkably increased in weight after 30-45 days of age. In the seminal vesicle and corpus prostatae at 1 day of age, the glandular tubules were characterized by an undeveloped epithelium and a narrow lumen. At 45-60 days of age, the terminal portions of the tubules of these glands were partially ramified and the lumen contained PAS-positive secretions. At 75-90 days of age, the portions presented a fully-developed structure. On the other hand, in the bulbourethral gland at 1 day of age, the terminal portions of the glandular tubules were already ramified and contained PAS-positive substances. At 30-45 days of age, they showed rapid growth and more ramifications and were filled with the secretions. After this age, their structural aspects presented no changes. These results indicate that the secretory function of the seminal vesicle, corpus prostatae and bulbourethral gland in Meishan boars is well developed at 75-90, 75-90 and 30-45 days of age, respectively.

Key words: Meishan boar, accessory genital gland, sexual maturity.

Meishan pigs, which belong to the Taihu breed of Chinese native pigs, are noted for their early sexual maturity. So far, we have reported the developmental process of the testis and epididymis in Meishan boars.

In boars, the accessory genital glands are composed of the seminal vesicle, prostate, bulbourethral gland and urethral gland. The developmental process of the glands was reported in Yorkshire, Berkshire, Large White and Poland China breeds; however, only limited data are available for Meishan boars. The objective of this study is to characterize the morphological and histological changes of the seminal vesicle, corpus prostatae and bulbourethral gland in Meishan boars after birth.

Materials and Methods

A total of 46 male offspring from Meishan pigs imported from the People's Republic of China to our experimental farm in 1987 were used. The pigs were housed and fed as previously described. The glands were collected after the recording of body weight at 1, 2, 7, 8, 30, 45, 60, 75, 90, 105, 120, 150, 180, 210, 270 and 364 days of age, and weighed. Each gland was cut into small pieces and fixed in 10% formalin in 0.1 M phosphate buffer for approximately 72 hr. The specimens were embedded in


paraffin-wax blocks, cut into 5-μm thick sections, and stained with hematoxylin and eosin or with periodic acid-Schiff’s reagent and hematoxylin.

The data were analyzed using t-tests15).

Results

Table 1 shows growth of the seminal vesicle, corpus prostatae and bulbo-urethral gland. The weight of all these glands increased rapidly between 30-45 and 150-180 days of age. The weight of the seminal vesicle continued to increase until at least 210 days of age. The ratio of glandular weight to body weight also increased after 30-45 days of age and reached a peak at 105-120 days.

In the seminal vesicle, the glandular parenchyma was a minor component at 1 day of age. The tubules showed no ramification, although they had narrow lumina (Fig. 1). At 45-60 days, the terminal portions of the tubules were partially ramified, lined with columnar cells, and the lumina were filled with PAS-positive secretions (Fig. 2). At 75-90 days of age, the terminal portions were well ramified, filled with the above secretions, and they occupied the majority of the parenchyma (Fig. 3). At 105 days of age, the terminal portions showed remarkable growth (Fig. 4), but no change was observed in the structural aspects.

From 1 to 30 days of age, the corpus prostatae revealed histological and histochemical aspects of the tubules that were similar to those observed in the seminal vesicle at 1 day of age (Fig. 5). At 45-60 days of age, PAS-positive substances appeared along the luminal border of the epithelium and in the lumina (Fig. 6). At 75-90 days of age, the terminal portions of the tubules were well ramified and filled with PAS-positive secretions (Fig. 7). At 105 days of age, the terminal portions continued to increase in size (Fig. 8), and presented a structural organization similar to that observed at 364 days.

In the bulbourethral gland, the scarce glandular parenchyma was divided into lobules by the intralobular stroma at 1 day of age. The glandular epithelium of the terminal portion was under development or already well-developed, and the lumina and collecting spaces contained PAS-positive substances (Fig. 9). At 30-45 days of age, a portion of the intralobular stroma was reduced. The terminal portion showed rapid growth and more ramifications and was filled with PAS-positive secretions (Fig. 10).

After this age, the glands presented

<table>
<thead>
<tr>
<th>Age (days)</th>
<th>No. of boars examined</th>
<th>Weight (g)</th>
<th>Ratio to body weight (×10⁻³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-8</td>
<td>6</td>
<td>0.3±0.1</td>
<td>0.2±0.0</td>
</tr>
<tr>
<td>30-45</td>
<td>7</td>
<td>1.1±0.2</td>
<td>2.2±0.0</td>
</tr>
<tr>
<td>60</td>
<td>4</td>
<td>5.5±2.0</td>
<td>4.5±2.0</td>
</tr>
<tr>
<td>75</td>
<td>5</td>
<td>15.3±2.4</td>
<td>13.3±2.4</td>
</tr>
<tr>
<td>90</td>
<td>7</td>
<td>19.6±2.1</td>
<td>1.7±0.2</td>
</tr>
<tr>
<td>105-120</td>
<td>9</td>
<td>50.9±3.8</td>
<td>3.9±0.4</td>
</tr>
<tr>
<td>150-180</td>
<td>5</td>
<td>81.1±6.4</td>
<td>7.2±1.4</td>
</tr>
<tr>
<td>210-364</td>
<td>3</td>
<td>108.8±6.5</td>
<td>7.0±0.5</td>
</tr>
</tbody>
</table>

Values are means±SEM.

*The weight was measured after removing the fluid contents.

Paired weight

Values within the same column with different superscript letters differ significantly, P<0.05.
Explanation of Figures

Histological sections of the accessory genital glands from Meishan boars at various ages. All tissues were fixed in 10% formalin in 0.1 M phosphate buffer, stained with periodic acid-Schiff’s reagent and hematoxylin (Figs. 1, 2, 5, 6, 7, 9 and 10) or with hematoxylin and eosin (Figs. 3, 4 and 8), and photographed. All bars indicate 100 μm.

Figs. 1, 2, 3 and 4  The seminal vesicle at 1, 45, 75 and 105 days of age, respectively.
Figs. 5, 6, 7 and 8  The corpus prostatæ at 1, 45, 75 and 105 days of age, respectively.
Figs. 9 and 10  The bulbourethral gland at 1 and 45 days of age, respectively.
no structural changes.

The histological aspects of the accessory genital glands from adult Meishan boars (Figs. 4, 8 and 10) were similar to those observed in other breeds\textsuperscript{1,14).}

Discussion

The seminal vesicle and corpus prostates increased rapidly in weight after 30-45 days of age. The first histological change was observed at 45-60 days of age. This developmental process seems to be in parallel with that observed in the testis\textsuperscript{6).} The marked development of the testis is accompanied by an elevation of serum testosterone concentration\textsuperscript{2).} Thus, the rapid growth and structural development of the glands, which are androgenic target organs, probably result from the increase in testosterone production by the testis. On the other hand, the bulbourethral gland already possessed developing tubules and secretions at 1 day of age and became identical in structural appearance with that of an adult boar at an early age. However, this gland didn't show a rapid increase in weight until at a later age. These observations are in agreement with the descriptions given in previous reports\textsuperscript{1,10,13), indicating that glandular development and secretory activity of the epithelium begin prior to birth, and that rapid growth after birth is due mainly to the above-mentioned increase in testosterone production. The other elevations of serum testosterone concentration were detected during the early foetal period and during the perinatal period\textsuperscript{3).} The anlage of the bulbourethral gland appeared at 30 days post coitum, i.e. immediately after the beginning of the first elevation, although the differentiation of the seminal vesicle and prostate didn't occur until 40 and 50 days post coitum, respectively\textsuperscript{33).} These findings suggest that the bulbourethral gland makes further development during the first elevation. This may be one of the causal factors for the earlier establishment of the structure in the gland.

The seminal vesicle, corpus prostates and bulbourethral gland presented a fully-developed structure at 75-90, 75-90 and 30-45 days of age, respectively. At these ages, the lumina of each gland contained a large amount of secretions. These observations suggest that the secretory function is well developed at these ages. However, the growth of the glands continued thereafter. According to our study\textsuperscript{6), the volume of the liquid portion and weight of gelatinous materials per ejaculate from Meishan boars significantly increased up to 10-11 months of age. Therefore, the glands of Meishan boars are considered to be completely matured at a much later age than are the histological structures established.

In Yorkshire boars\textsuperscript{4,12,13), the seminal vesicle, corpus prostates and bulbourethral gland greatly increase in weight between approximately 3 and 7 months of age, and present well-developed structures at 5, 4 and 2 months, respectively. In Berkshire\textsuperscript{10), Large White\textsuperscript{11) and Poland China boars\textsuperscript{11), the glands grow remarkably from 5-6 to 9-11 months of age. Based on the present results, it appears that the rapid growth and structural development of the accessory genital glands occur at an earlier age in Meishan boars than in European and American breeds. This may be due mainly to the precocious elevation of the serum testosterone concentration in parallel with the marked development of the testis at an earlier age\textsuperscript{6).}

References

Accessory Genital Glands of Meishan Boars


雄梅山豚における副生殖腺の発達

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生後の雄梅山豚における精のう腺，前立腺体部および尿道球腺の発達過程を形態学的および組織学的に観察した。すべての副生殖腺の重量は30〜45日齢以後に顕著に増加した。1日齢の精のう腺および前立腺体部では，腺上皮は未発達で，腺腔の拡大も不十分であった。しかし，45〜60日齢になると，腺の終末部に部分的な分枝が見られ，腺腔にはPAS陽性の分泌物が認められた。75〜90日齢では，腺の終末部は十分に発達した組織像を示した。他方，尿道球腺については，1日齢で腺の終末部に分枝が見られ，腺腔内にはPAS陽性の分泌物が観察された。30〜45日齢になると，終末部は急速に拡大するとともに，分枝を増し，腺腔はPAS陽性物質で満たされていた。以上の結果から，雄梅山豚の精のう腺，前立腺体部および尿道球腺は，それぞれ75〜90日齢，75〜90日齢および30〜45日齢には十分に発達した分泌機能を備えると考えられる。

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