



รายงานวิจัยฉบับสมบูรณ์

โครงการ: การศึกษาพยาธิวิทยาของอวัยวะสืบพันธุ์ในสุกรสาว
ที่มีปัญหาทางการสืบพันธุ์

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สนับสนุนโดยสำนักงานคณะกรรมการอุดมศึกษา และสำนักงานกองทุนสนับสนุนการวิจัย

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บทคัดย่อ

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ชื่อโครงการ: การศึกษาพยาธิวิทยาของอวัยวะสืบพันธุ์ในสุกรสาวที่มีปัญหาทางการสืบพันธุ์

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การศึกษานี้มีวัตถุประสงค์เพื่อตรวจความผิดปกติของอวัยวะสืบพันธุ์ ของสุกรสาว ทดแทนที่ถูกคัดทิ้งเนื่องจากปัญหาความล้มเหลวทางระบบสืบพันธุ์ และศึกษาความสัมพันธ์ระหว่าง พยาธิสภาพที่ตรวจพบกับข้อมูลทางระบบสืบพันธุ์ เก็บตัวอย่างระหว่าง กรกฎาคม 2548-กันยายน 2550 จากสุกรสาวทดแทนจำนวน 212 ตัว จากฟาร์มสุกรจำนวน 7 แห่ง ข้อมูลของประวัติสุกรและ สาเหตุการคัดทิ้งถูกนำมาวิเคราะห์ ลักษณะทางพยาธิวิทยาที่ทำการศึกษาประกอบด้วย ขนาด น้ำหนัก และความผิดปกติของรังไข่ และท่อทางเดินระบบสืบพันธุ์ ข้อมูลสมรรถภาพทางการ สืบพันธุ์ของสุกรถูกนำมาประมวลผลและวิเคราะห์ด้วยสถิติแบบพรรณนา โดยเฉลี่ยสุกรสาวถูกคัด ทิ้งเมื่ออายุ 321.3 ± 50.8 วัน ที่น้ำหนักเฉลี่ย 145.9 ± 24.2 กก. สุกรสาวแสดงการเป็นสัดครั้งแรก เมื่ออายุเฉลี่ย 252.1 วัน และถูกผสมเมื่ออายุ 267.9 วัน ระยะตั้งแต่เข้าสู่ถึงคัดทิ้งเฉลี่ย 96.3 วัน สาเหตุการคัดทิ้งสุกรสาว ประกอบด้วย ไม่เป็นสัด (43.7%) หนองไหล (20.7%) ผสมซ้ำ (15.4%) ไม่ท้อง (8.2%) แท้ง (8.2%) และ อื่นๆ (3.8%) 50.9 % ของสุกรสาวที่ถูกคัดทิ้งทั้งหมด มีอวัยวะ สืบพันธุ์ปกติ ในขณะที่ 49.1% มีลักษณะที่ผิดปกติอย่างน้อย 1 อย่าง ความผิดปกติของ รังไข่ ท่อ นำไข่ มดลูก คอมดลูก และช่องคลอด ตรวจพบใน 15.4% 4.3% 21.7% 16.2% และ 17.1% ของสุกรสาว ตามลำดับ ลักษณะทางพยาธิวิทยาที่พบมาก ประกอบด้วย ถุงน้ำรังไข่ (10.1%) มดลูกเป็นหนอง (11.5%) และ ความผิดปกติแต่กำเนิด (7.7%) 52.7% ของสุกรสาวที่ถูกคัดทิ้ง เนื่องจากปัญหาไม่เป็นสัด พบว่ายังไม่เข้าสู่วัยเจริญพันธุ์ สุกรสาวที่ถูกคัดทิ้งเนื่องจากปัญหาหนอง ไหลและผสมซ้ำ ส่วนใหญ่พบว่าผ่านการมีวงรอบการเป็นสัดมาแล้ว (90.7% และ 96.9% ตามลำดับ) ปัญหาถุงน้ำรังไข่ส่วนมากพบในสุกรสาวที่ถูกคัดทิ้งเนื่องจากผสมซ้ำ (15.6%) และ หนองไหล (18.6%)

คำสำคัญ: สุกร ระบบสืบพันธุ์ พยาธิวิทยา รังไข่ มดลูก

Abstract

Project code: MRG4880127

Project title: Post-mortem examination on the genital organs of the replacement gilts culled due to reproductive failure

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Project period: 1 June 2005-31 May 2007

The present study aims to investigate genital organs of the replacement gilts culled due to reproductive failure and to study the relationship between macroscopic findings and the reproductive data. The experiment was carried out during July 2005-September 2006 and included 212 genital organs from 7 swine herds. Historical data and reasons of culling were analyzed. The macroscopic examination focused on the length, the weight and the abnormalities of ovaries and reproductive tracts. Descriptive statistics and frequency analysis were conducted for all reproductive parameters. On average, the gilts were culled at 321.3 ± 50.8 days of age with a body weight of 145.9 ± 24.2 kg. The gilts expressed first oestrus at 252.1 days and were mated at 267.9 days of age. The interval from entry-culling was on average 96.3 days. The culling reasons of gilts included anoestrus (43.7%), vaginal discharge (20.7%), repeat mating (15.4%), not pregnant (8.2%), abortion (8.2%) and others (3.8%). Of all gilts, 50.9% had normal genital organs, while 49.1% had at least one abnormality. The abnormalities of the ovary, oviduct, uterus, cervix and vagina-vestibule were found in 15.4%, 4.3%, 21.7%, 16.2% and 17.1% of the gilts, respectively. The common macroscopic findings included cystic ovaries (10.1%), pyometra (11.5%) and congenital abnormality (7.7%). Of the gilts culled due to anoestrus, 52.7% were pre-puberty. Most of the gilts that were culled due to vaginal discharge and repeat mating had been cycling (90.7% and 96.9%, respectively). High proportions of cystic ovaries were found in gilts culled due to repeat breeding (15.6%) and vaginal discharge (18.6%).

Keywords: Pig, Reproduction, Pathology, Ovary, Uterus

Post-mortem examination on the genital organs of the replacement gilts culled due to reproductive failure

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Abstract

The present study aims to investigate genital organs of the replacement gilts culled due to reproductive failure and to study the relationship between macroscopic findings and the reproductive data. The experiment was carried out during July 2005-September 2006 and included 212 genital organs from 7 swine herds. Historical data and reasons of culling were analyzed. The macroscopic examination focused on the length, the weight and the abnormalities of ovaries and reproductive tracts. Descriptive statistics and frequency analysis were conducted for all reproductive parameters. On average, the gilts were culled at 321.3 ± 50.8 days of age with a body weight of 145.9 ± 24.2 kg. The gilts expressed first oestrus at 252.1 days and were mated at 267.9 days of age. The interval from entry-culling was on average 96.3 days. The culling reasons of gilts included anoestrus (43.7%), vaginal discharge (20.7%), repeat mating (15.4%), not pregnant (8.2%), abortion (8.2%) and others (3.8%). Of all gilts, 50.9% had normal genital organs, while 49.1% had at least one abnormality. The abnormalities of the ovary, oviduct, uterus, cervix and vagina-vestibule were found in 15.4%, 4.3%, 21.7%, 16.2% and 17.1% of the gilts, respectively. The common macroscopic findings included cystic ovaries (10.1%), pyometra (11.5%) and congenital abnormality (7.7%). Of the gilts culled due to anoestrus, 52.7% were pre-puberty. Most of the gilts that were culled due to vaginal discharge and repeat mating had been cycling (90.7% and 96.9%, respectively). High proportions of cystic ovaries were found in gilts culled due to repeat breeding (15.6%) and vaginal discharge (18.6%).

Keywords: Pig, Reproduction, Pathology, Ovary, Uterus

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1. Introduction

In Thailand, the crossbred Landrace and Yorkshire (LY) gilts attained puberty at 196 days, 106 kg body weight (BW) with a backfat thickness (BF) of 13.0 mm [1]. A great variation in the age at which puberty was reached in the gilts was observed [1-3]. Factors like breed, season, nutrition and management have been shown to influence age at puberty of gilt [1-3]. In practice, the replacement gilts were usually mated at the second or later observed oestrus at about 7-9 months of age. The age at the first observed oestrus in gilts associate with their subsequent reproductive performance and prompt the first mating [1,4,5]. Schukken et al. [6] found that age at first conception influence their longevity and the culling reasons. The gilts with a high age at first conception had a shorter longevity and tend to be culled due to reproductive failure. The age at first conception of gilts should be 200-230 days [5,6]. In Thailand, the age at first mating of gilts was 265.2 ± 40.4 days [7]. The impaired reproductive traits of gilt under hot and humid climate countries remained to be further investigated.

The reproductive performances of the gilts influence total production of the pig farm because the proportion of gilts in a herd is highest among females. Selection of good replacement gilts into a herd is therefore important. In general, 35-55% of the sows in the breeding herd are

replaced by gilts annually [8]. In practice, a certain number of gilts were culled before the first litter was completed, due to various causes such as leg problems and reproductive failure [9]. In Thailand, 47.1% of the culling reasons of gilts were associated with reproductive problems. This number varied between 36.4-61.0% among herds [9]. Common reproductive problems of the culled gilts included anoestrus, repeat mating, not pregnant, vaginal discharge, abortion and dystocia [9,10]. Under tropical climate, the incidence of anoestrus and abortion was highest in summer [9]. The investigation on the genital organs of gilts that were culled due to reproductive problems is important for clinical diagnosis.

A number of earlier studies demonstrated that retrospective study based on slaughterhouse materials in pigs is a useful tool for clinical diagnosis for the reproductive disturbance [10-15]. For instance, in Sweden, the reproductive organs from 1,000 gilts with a BW between 85-100 kg were investigated and it was found that 0.3% was true hermaphrodite, 0.4% had uterine unicornis and 0.4% had segmental aplasia of the uterine horn [11]. In Finland, 1,708 reproductive organs of female pigs were examined and it was found that 52.3% of the organs were macroscopically normal. The main pathological findings included inactive ovaries 25.1%, par-ovarian cyst 22.9%, ovarian cyst 6.2% and uterine disorder 1.4% [10]. In Thailand, Kunavongkrit et al. [16] investigated ovaries and the reproductive tracts of 1,000 gilts from slaughterhouse and found that 16.4% had the reproductive abnormality and 83.6% were normal. Among the normal cycling gilts, 59.7% had been ovulated, while 40.3% had not ovulated. However, the study was carried out in the fattening pig from slaughterhouse (not the breeder) and the history of the pig was unknown. Furthermore, few studies have been related the pathological findings with the individual historical data of the animals. Dalin et al. [14] investigated the reproductive organs of 34 gilts and 81 sows in the Swedish sow pool in relation with the culling reasons. It was found that most of the female pigs were culled due to repeat breeding (67%) and the main pathological findings included post-weaning anoestrus (17%) and multiple ovarian cyst (14%) [14]. Histological study from these genital organs revealed that 27% of the pigs had endometritis problems and the anoestrus pig had a higher incidence of endometritis than cycling pig (61% versus 19%) [14]. Recently, post-mortem examination of the genital organs from 150 sows culled due to reproductive disturbance revealed that 26.6% were anoestrus, 4.7% had multiple ovarian cyst and 68.7% were normal [15]. In tropical countries, no comprehensive study based on slaughterhouse material of replacement gilts in relation to the historical data has been performed. In addition, information concerning reproductive data, cause of culling as well as any contributing factors is not well established. The objective of the present study was to investigate genital organs of the replacement gilts that were culled due to reproductive failure and to study the relationship of these macroscopic findings with the reproductive data such as culling reason, age, BW and the mating history of the gilts under the tropics.

2. Material and Methods

2.1 Animal and sample collection

The experiment was carried out during July 2005-September 2006. Two hundred twelve samples of the genital organs from 4 Landrace (L), 4 Yorkshire (Y) and 204 crossbred Landrace x Yorkshire (LY) gilts were collected from 7 swine herds in Thailand. Historical data of all gilts was collected. The data included herd, gilt's identity, breed, birth date, date that the gilts enter the herd, first observed oestrus date, culling date, mating date, the BW at culling and the reason of culling. The genital organs of the slaughter gilts including ovaries, oviducts, uterus, cervix, vagina, vestibule and vulva were collected from the slaughterhouse within the herd or near the herd within 24 h after culling. The samples were placed in an ice box and sent to the laboratory within 24 h after slaughter.

2.2 Herd management

All herds included in the present study were the swine breeding herd and the number of sows on production in the herds was approximately 1,000-3,500 sows/herd. Four herds produced the replacement gilts within the herds using their own grand parent (GP) stock, while 2 herds bought the replacement gilts from other breeding herds at about 20-24 weeks of age. In one herd, the replacement gilts were brought into the herd at about 8 week of age. In most case, the gilts entered the gilts pool at about 20-24 week of age and between 80-100 kg BW. However, in most cases (6/7 herds) the farmer considered the day that the gilts were sent to the breeding house as the date of entering the herds and used this criteria as a herd recorded data. All of the gilts were housed in an open housing system with facilities to reduce temperature such as water springer, fan and the roof with sun block material. The health of the herds was controlled by the herd veterinarian. In general, veterinarian gave recommendation to vaccinate the gilts with Foot-and-mouth disease (FMD), Swine fever (SF), Aujeszky's disease (AD) and Porcine parvo virus (PPV) vaccine during 22-30 week of age. Some herds also give some extra vaccine to the gilts including Porcine reproductive and respiratory syndrome (PRRS), Atrophic rhinitis disease (AR), Mycoplasma disease and Actinobacillus pleuropneumoniae (APP). Swine erysipelas and Leptospirosis vaccine were in most case combined with the PPV vaccine. The type of the vaccine, the vaccination program and the manufacturing of the vaccine differ among herds. The gilts were kept in a pen with a group size of between 6-15 gilts/pen (depending on herds) with a density of 1.5-2.0 m²/gilt. Oestrus detection was performed daily using an observation for vulva symptom and a back pressure test in the presence of a mature boar, in most case, using fence line contact. The gilts were provided with water up to ad libitum using the water nipples and were fed twice a day (about 3 kg of feed/gilt/day). The feed was a corn-soybean-fish base containing about 16-18% crude protein, 3,000-3,250 kcal/kg metabolisable energy (ME) and 0.85-1.1% lysine. In general, the herds recommended to breed the replacement at about 32 week of age onwards with a BW of at least 130 kg at the second or later observed oestrus. The mating technique for all herds was performed by a conventional artificial insemination (AI).

2.3 Post-mortem examination

Post-mortem examination was performed on each part of the reproductive organs within 48 h after culling. The investigation focused on the length, the weight and the abnormality of the ovaries, oviducts, uterine horns, uterine body, cervix, vagina and vestibule.

Ovary and oviduct

The ovaries were weighted. The number and diameter of corpora lutea (CL) and number follicles with diameter ≥ 0.5 cm were counted. The ovaries were defined as being active when the ovaries contained CL or corpora albicans (old CL) and follicles. In addition, the active ovaries were classified as luteal phase when CL were being active and its diameter was larger than follicles and follicular phase when follicle's diameter was larger than CL. The ovaries were defined as pre-pubertal phase when ovaries contained follicles but had no CL or corpora albicans. The gilts were defined as cystic ovaries when the formation of single or multiple cysts with diameter ≥ 1.5 cm were found. The cystic ovaries were also classified as single cyst (one cyst/gilt) and multiple cysts (≥ 2 cyst/gilt). The oviducts were dissected from the mesosalpinx and were measured for the length and the abnormality. Number and diameter of par-ovarian cyst, including the formation of cyst in the mesovarium and mesosalpinx, were measured.

Uterus

The uterine horn and the uterine body were dissected from the broad ligament and were weighted. The length of the left and right uterine horn and the uterine body were measured. The uterine horns were opened longitudinally and the endometrium was investigated. The macroscopic appearance of the endometrium was classified as normal, edema/congestion, pyometra and pregnancy (death fetuses, mummified fetuses or macerated fetuses).

Cervix, vagina, vestibule, vulva and urinary bladder (UB)

The cervix was measured for length and the number of cervical fold. The vagina and vestibule were measured. The organs were dissected longitudinally and the epithelium were observed for abnormality. The appearance of the epithelium of the cervix, vagina and vestibule were classified as normal, edema/congestion and pyometra. The urinary bladder (UB) were dissected longitudinally and were examined for cystitis, cystic calculi and others abnormality.

Reproductive status of the gilts

The reproductive status of the gilt was classified according to the appearance of the ovaries and the uterus as pre-puberty, follicular phase, luteal phase and pregnancy. The gilts were defined as pre-puberty when the ovaries had no CL and contained follicles. The cyclic gilt was defined as follicular phase when follicles were ≥ 0.5 cm in diameter and small CL (≤ 0.4 cm or CL that smaller than follicle) were presented. The gilt was defined as luteal phase when large CL (diameter ≥ 0.5 cm or CL that larger than follicle) was presented. The gilts were defined as pregnancy when CL was presented in the ovaries and fetuses were presented in the uterus.

2.4 Statistical analysis

The statistical analyses were performed using SAS version 9.0 (SAS Institute Inc., Cary, NC, USA, 2002). Descriptive statistics (means, standard deviation and range) and frequency table were conducted for all reproductive parameters. Age of gilts at first observed oestrus, age at first mating, age at entry, age at culling, interval from entry to culling (non-productive day, NPD), BW at culling and the average daily gain from birth to culling were analyzed. The number of CL, the number of corpora albicans and the number of follicles were analyzed. Pair *t*-test was used to compare the number of ovulation, length of the uterine horns and length of the oviducts between left and right sides within animal. The incidences of the pathological changes/ abnormalities of the genital organs were described as proportional data using FREQ procedure. The proportional data i.e., percentage of cystic ovaries, percentage of pyometra, percentage of par-ovarian cyst and percentage of pathological changes/ abnormalities at different parts of the genital organs were analyzed by logistic regression (GENMOD procedure). The weight of the ovaries, the length of the cervix, vagina and vestibule were analysed using general linear model (GLM) procedure. The statistical models included reproductive status as independent variable. The effect of the reproductive status on the weight of the uterus, the length of the uterine horns, the length of the uterine body and the total length of the uterus were analyzed using multiple ANOVA. The statistical models included the reproductive status as an independent variable and included the BW of the gilts as a co-variance. Least-square means were obtained from each class of the factor and were compared by Student's *t*-test. $P < 0.05$ was considered as statistical significance.

3. Results

3.1 Reproductive data

On average, the gilts entered the herd (entered the breeding house) at 235.5 days of age and were culled at 321.3 days of age with a BW of 145.9 kg (Table 1). The interval between entering the herd and culling (non-productive day, NPD) was on average 96.3 days (Table 1). The age of the gilts when enter the herd varied from 173.0-263.7 days among the herds. The age at culling among the herds varied from 276.5-338.9 days and the NPD among the herds varied from 60.5-139.0 days. The mean of the BW at culling varied from 128.2-170.5 kg among the herds. The average daily gain (ADG) from birth to culling of the gilts was 457.0 g/d (Table 1). The means of ADG of the culling gilts varied from 380.8-571.0 g/d among the herds. The average age at culling, ADG and NPD of gilts by culling reason were presented in Table 2.

Of the 212 slaughtered gilts, 96 gilts (45.3%) have been mated. Among the 96 gilts that had been mated, 48 gilts (50%) had shown oestrus signs at least once before mating. On average, the age at first observed oestrus was 252.1 days and the age at first mating was 267.9 days (Table 1). The interval between first observed oestrus and mating varied considerably from 0-80 days

(means=17.2 days). The interval from entry to first mating was 25.6 days (0-115 days). This interval was also varied among the herds from 7.5-86.8 days.

3.2 Culling reason and the reproductive status of the gilts

The present study revealed that the culling reasons of gilts that had reproductive disturbance included anoestrus (43.7%), vaginal discharge (20.7%), repeat mating (15.4%), not pregnant (8.2%), abortion (8.2%), not-in-pig (1.9%), delayed farrowing (1.4%) and long oestrus behaviour (0.5%) (Table 2). The culling reasons in relation to the reproductive status of the gilts are presented in Table 2. The macroscopic examination of the ovaries and the uterine horns revealed that 118 gilts (55.7%) were culled during the luteal phase (dioestrus), 58 gilts (27.4%) were culled before puberty, 31 gilts (14.6%) were culled during follicular phase (pro-oestrus and oestrus) and 5 gilts (2.4%) were culled during pregnant.

Based on the ovarian appearance, 52.7% of the gilts culled due to anoestrus were pre-puberty (no CL), while 47.3% have been cycling (Table 3). Most of the gilts that were culled due to vaginal discharge had been cycling (90.7%) (Table 3). Of the vaginal discharge gilts, 65.1% were in luteal phase and 25.6% were in follicular phase. Of the gilts that were culled due to repeat mating, 96.9% had normal cycling varies, while only 3.1% had inactive ovaries (Table 3).

3.3 Culling reasons and the pathological changes/ abnormalities of the reproductive tracts

Table 4 and 5 demonstrated the overall pathological changes/ abnormalities and some specific abnormalities of the ovaries and the female reproductive tracts in relation to the culling reasons. The types of pathological changes/ abnormalities were presented below (see 3.5 and 3.6). In total, the abnormalities of the gilt's genital organs were found in the uterus, cervix and vagina more than the oviduct and UB ($P \leq 0.05$) (Table 4). Of the gilts culled due to anoestrus, the percentages of pathological changes/abnormalities were found in the uterus more than the cervix ($P \leq 0.05$). Gilts culled due to vaginal discharge had pathological changes/abnormalities in the uterus, cervix and ovary more than the oviduct ($P < 0.05$) (Table 4).

The incidence of cystic ovaries was found in the gilts culled due to vaginal discharge and repeat breeding more than gilts culled due to other reasons (Table 5). It was found that 18.6% of gilts culled due to vaginal discharge had pus exudates in the uterus and was defined as pyometra (Table 5). The uterine congestion without pus exudates and other abnormalities was observed in 33.3 % of the gilts culled due to vaginal discharge and 45.5% of gilts culled due to abortion (Table 5). The congestion of the oviduct was also found in 9.1% of gilts and found most in gilts culled due to repeat breeding (16.7%).

3.4 Ovulation, weight, size and length of the gilt's reproductive tract

Of 212 gilts, 108 gilts (50.9%) had normal genital organs, while 104 gilts (49.1%) had at least one pathological change/ abnormality. The pathological findings/ abnormalities of the genital organs are presented below (see 3.5 and 3.6). On average, the number of CL in both ovaries was 15.9 ± 3.6 ova (range 4-27) and the number of corpus albican (old CL) was 15.8 ± 5.7 ova (range 6-32) ($P=0.2$). The ovulation rate in macroscopically normal ovary was 8.2 ± 3.0 ova on the left side and 7.8 ± 3.4 ova on the right side ($P=0.5$) (Table 6). The diameter of the CL was 0.9 ± 0.2 cm (0.5-1.4 cm). In the pre-pubertal gilts, the diameter of follicle was measured. It was found that 44/58 (74.9%) had follicle with diameter ≥ 5 mm and 14/58 (24.1%) had follicle with diameter < 5 mm.

The weight and size of the ovary, the length of the oviduct, the weight and length of the uterus of macroscopically normal genital organs are presented in Table 7 and 8. The weight of the ovary was 3.1 g in pre-pubertal gilts, 5.1 g in follicular phase gilts and 6.9 g in luteal phase gilts (Table 7). Weight of the ovaries and the uterus were significantly affected by the reproductive

status (Table 7 and 8). The ovary of the follicular phase, luteal phase and pregnant gilts was 1.6, 2.2 and 2.7 times heavier than pre-pubertal gilts, respectively ($P<0.05$) (Table 7).

The means weight of the uterus, the length of the uterine horn, the length of the uterine body and total length of the uterus in the gilts that have normal uterus are presented in Table 8. On average, the weight of the uterus varied from 50-1493 g. The weight of the uterus varied from 237-1493 g during luteal phase, 182-1180 g during follicular phase and 50-421 g during pre-puberty. The uterus of the follicular and luteal phase gilts was 5.4 and 5.6 times heavier than pre-pubertal gilts, respectively ($P<0.001$). The weight of the uterus was significantly correlated with the total length of the uterine horn ($r=0.79$, $P<0.001$) and BW of the gilts ($r=0.52$, $P<0.001$). The length of the oviduct and the uterine horn were also significantly increased after puberty (Table 7 and 8).

Pregnant gilts was found in 2.4% of the slaughtered gilts (5 gilts) in the present study with reasons of culling i.e., delayed farrowing (3 gilts), not-in-pig (1 gilt) and not-pregnant (1 gilt). It was found that all of these pregnant gilts had mummified fetuses. The size of the mummified fetuses varied from 3.5-19.0 cm (about 35-80 days of age). The number of fetuses in these gilts was 14.8 ± 1.8 fetuses (12-16 fetuses).

3.5 Pathological change/ abnormality of the ovary and oviduct

Pathological change/ abnormality of the ovaries were found in 32 gilts (15.1%). The pathological change/ abnormality included multiple ovarian cyst 11 gilts (5.2%), single ovarian cyst 10 gilts (4.7%), ovarian adhesion 6 gilts (2.8%), haemorrhage 3 gilts (1.4%), unilateral small ovary 1 gilts (0.5%) and ovo-testis 1 gilts (0.5%). High proportions of cystic ovaries were found in gilts culled due to repeat breeding (15.6%) and vaginal discharge (18.6%) (Table 5). Of the 21 cystic ovaries gilts, 18 gilts (85.7%) were in luteal phase and 3 gilts (14.3%) were in follicular phase ($P=0.007$). None of cystic ovary was found in pre-pubertal and pregnant gilts.

The pathological change/ abnormality of the oviduct consisted of pyosalpinx 3 gilts (1.4%), hydrosalpinx 2 gilts (0.9%), segmental aplasia 2 gilts (0.9%), unilateral short oviduct 1 gilt (0.5%) and blood clot obstruction 1 gilts (0.5%). Among the normal oviducts, many degree of oviductal congestion was observed. In total, 9.1% of normal oviducts were congestion. The highest proportion of the oviductal congestion was found in gilts culled due to repeat breeding (16.7%) (Table 5). Of the normal oviduct, the oviductal congestion was found in 17.7% during follicular phase, 10.6% during luteal phase and 3.5% during pre-puberty ($P=0.09$).

3.6 Pathological change/ abnormality of the uterus, cervix, vagina and vestibule

The pathological changes/ abnormality of the uterus were found in 46 gilts (21.7%). The findings included pyometra/ metritis 29 gilts (13.7%), segmental aplasia 5 gilts (2.4%), mummified fetuses 5 gilts (2.4%), no uterine body 2 gilts (0.9%), cystic calculi in the uterus 2 gilts (0.9%), segmental hypoplasia 1 gilt (0.5%), uterine unicornis 1 gilt (0.5%) and polyps at the uterine horn 1 gilt (0.5%). Among the normal uterus, degrees of edema and/or congestion were found. It was found that 42% of the normal uterus was identified as edema, congestion or both. The association between uterine congestion of the uterus and the reason of culling are presented in Table 5. The uterine edema was found in 63.6% of the follicular phase gilts, 30.5% of the luteal phase gilts and 16.3% of the pre-pubertal gilts ($P<0.001$). The uterine congestion was found in 18.1% of the follicular phase gilts, 33.7% of the luteal phase gilts and 6.1% of the pre-pubertal gilts ($P<0.001$).

The pathological change/ abnormality of the cervix were found in 34 gilts (16.2%). The findings included cervicitis 19 gilts (9.1%), haemorrhage 12 gilts (5.7%), segmental aplasia 1 gilt (0.5%), flat cervical fold 1 gilt (0.5%) and cystic calculi in the cervix 1 gilt (0.5%).

The pathological change/ abnormality of the vagina and vestibule were found in 35 gilts (17.1%). The findings consisted of vaginitis 20 gilts (9.8%), vestibulitis 6 gilts (2.9%), clitoris

hypertrophy 2 gilts (1%), haemorrhage 2 gilts (1%), vaginal aplasia 1 gilt (0.5%), double vagina 1 gilt (0.5%), cystic calculi in the vagina 1 gilt (0.5%) and trauma 1 gilt (0.5%).

Persistent hymen was found in 19% of the gilts (39/205 gilts) and was regarded as normal. Of the persistent hymen gilts, 64.1% (25 gilts) were in the luteal phase, 25.6% (10 gilts) were pre-puberty and 10.3% were in the follicular phase ($P=0.6$). None of the pregnant gilts had persistent hymen. Of the gilts that had persistent hymen, 56.4% had not been mated, while 43.6% had been mated ($P=0.8$).

The abnormalities of the UB were observed in 19 gilts out of 205 gilts (9.3%). These abnormalities included cystitis 9 gilts (4.4%), cystic calculi 6 gilts (2.9%) and haemorrhage of the UB epithelium 4 gilts (2.0%).

3.7 Par-ovarian cyst

Par-ovarian cyst was observed in 29.7% (63/212) of the gilt. The percentage of par-ovarian cyst did not differ significantly between the gilts with pathological changes/abnormalities and normal gilts (32.7 versus 26.9%; $P=0.3$). The incidence of cystic ovaries was associated with the incidence of par-ovarian cyst. 52.4% of the gilts that had cystic ovaries had par-ovarian cyst, while 27.2% gilts that had no cystic ovaries had par-ovarian cyst ($P=0.02$). The pathological change/ abnormality of oviduct, uterus, cervix, vagina and UB were not associated with the percentage of par-ovarian cyst ($P\geq 0.05$). The percentage of par-ovarian cyst differed significantly between the stages of the oestrus cycle. The proportion of par-ovarian cyst was found during luteal phase more than pre-pubertal gilts ($P\leq 0.05$) (Table 7). On average, the diameter of the par-ovarian cyst was 0.7 ± 0.5 cm (range 0.1-2.5 cm) and the number of par-ovarian cyst per gilt was 1.6 ± 0.9 cysts (range 1-6). 81.1% of the par-ovarian cyst had diameter ≤ 1.0 cm.

4. Discussion

In the present study, 50.9% of the gilts had normal genital organs, while 49.1% had at least one pathological change/ abnormality. Similarly, in Sweden, 49.6% of 115 genital organs from gilts and sows culled due to reproductive disturbance had no pathological changes [14]. In Lithuanian, 68.7% of 150 sows culled due to reproductive disturbance had normal cycling ovaries and no pathological changes of the genital organs [15]. In Finland, a large data from slaughter house material in both gilts and sows indicated that 52.3% of the reproductive organs was normal, 25.5% found inactive ovaries, 22.9% of the genital organs contained par ovarian cyst, 6.2% of the ovaries had single or multiple cyst, 1.4% of the organs had uterine disorder, 1.1% had ovarian adhesion and 0.8% had congenital abnormalities [10]. This previous study was not related the genital organs with the gilts and sows data from the herd and these animals were culled due to various reasons not only the reproductive failure. In the present study, the organs were only obtained from gilts culled due to reproductive failure. The common macroscopic findings included cystic ovaries (10.1%), pyometra (11.5%) and congenital abnormality (7.7%). In the present study, inactive ovaries (no CL) were found in 27.4% of the gilts and were classified as normal pre-pubertal gilts. Par-ovarian cyst was observed in 29.7% of the gilts and was regarded as normal. Cystic ovaries, delayed puberty, pyometra and par-ovarian cysts are discussed below (see 4.4-4.7).

4.1 Reproductive data

Under tropical climate, normal gilts attained puberty at about 28 week of age [1]. In the present study, most of the gilts were culled before mating and among those that have been mate only half of them have shown sign of oestrus. In the present study, the age at first observed oestrus was 252 days (36 week) and the age at first mating was about 268 days (38 week), while the average age at culling of these gilts was nearly 44 weeks. These data indicated that delayed

puberty and/or poor oestrus detection might be the most common problems in the replacement gilts. The age of the gilts at first mating (268 day) was in agreement with earlier studies, who demonstrated that, in Thailand, the replacement gilts were inseminated for the first time at about 265.2 days of age [7,17]. In USA., the age at first mating of crossbred LY gilts was 256 days [5] and in Sweden, the age at first mating of purebred L and Y gilts were 237 and 247 days, respectively [18]. In Thailand, a recent genetic study found that the age at first conception in purebred L gilts was 251.2 days and the selection for low age at first conception increased total number of piglets born/ litter [19]. These studies indicated that both purebred L and crossbred LY gilts were likely to be mated at an older age than gilts in Europe and USA. Base on an economic evaluation, Schukken et al. [6] demonstrated that the gilts should have been conceived since 220 days of age. Koketsu et al. [5] found that gilts mated later than 230 days of age had inferior subsequent reproductive performance and longevity. Gilts bred at an older age had a shorter herd life and had a higher risk to be culled due to infertility problems [6]. Tummaruk et al. [1] found that gilts express first oestrus between 180-200 days of age had larger litter size during the first three parity than those express first oestrus between 201-220 days. Base on these data, we suggested that the oestrus behaviour and/or oestrus detection of the replacement gilts raised under tropical climate need to be improved. Factors like breed, genetic line, nutrition, housing and general management should be further investigated.

In the present study, the NPD of the culling gilts was on average 96.3 days. Earlier studies found that the NPD was 82 days in culled sows and 151 days in culled gilts [14]. However, this should be interpreted with caution due to the NPD base on the present study was the interval from entry to culling, while the NPD from earlier study was the interval from mating to culling. In the present study, the gilts were mated at about 25.6 days after enter the herds. In the present study, the gilts that were culled due to not-in-pig lose NPD most (191.3 days), while the gilts culled due to vaginal discharge lose NPD least (61.1 days). For some specific culling reason, Dalin et al. [14] found that the repeat breeder had a mean NPD of 102 days. In the present study, the gilts culled due to repeat breeding had a mean NPD of 108.3 days. Little information concerning the NPD of the replacement gilts and the culled sows are available to be discussed. However, this reproductive traits is very important for the over all production of the breeding herd [20]. Data collection, herd record keeping and retrospective study in this trait are of interest to be analyzed further.

4.2 Culling reasons

In the present study, anoestrus was the most common culling reason of the replacement gilts. The appearance of the ovaries also indicated that more than half (52.7%) of these gilts had not reach puberty (no CL). This was in agreement with our previous study based on herd recorded data, which found that the most common reason for culling the gilts from breeding herds were reproductive failure (47.1%) and anoestrus was the most common reproductive problems of gilts [9]. Beside the anoestrus, repeat mating, not-pregnant and vaginal discharges were also common [9]. Similar findings have been shown in Sweden when both sows and gilts reproductive organs were collected and the top five common reproductive problems for culling sows and gilts consisted of repeated breeding, no oestrus, not pregnant, vaginal discharge and abortion [14]. Most of the culled animals having reproductive disturbance were gilts (29.4%) and first parity sows (40%) [14]. Ehnvall et al. [12] found that reproductive failure, especially anoestrus, was the most common reasons (66.9%) of culling gilts from a breeding herd. In addition, gilts born from January-March (attain puberty in summer-autumn) had a significantly higher incidence of anoestrus compared to gilts in other seasons [12]. In Finland, data from herd record survey indicated that no pregnancy (15.7%), no heat (13.7%) and poor piglets production (12.8%) were common reproductive problems in gilts [10]. In Minnesota, 57.4% of the culling reason in gilts was reproductive failure and common reproductive problems in gilts included failure to conceive (65%), anoestrus (33%) and abortion (2%) [21]. In Lithuanian, the most common reproductive

problem among the culled sows was anoestrus (43.3%) and data from post-mortem examination indicated that 26.6% of 150 culled sows were pathologically anoestrus [15]. In the present study, the proportion of inactive ovaries among the anoestrus gilts (52.7%) was higher than previous findings in sows (26.6%) [15]. Additionally, in the present study, it was found that most of the gilts that were culled due to vaginal discharge had active ovaries (90.7%). Different results was observed in post-weaning anoestrus sows that the incidence of endometritis was found in anoestrus animals more than cycling ovarian activity (61% versus 19%) [14]. Previous study indicated that ovarian activity is of important for the development of endometritis [14]. However, the mild or subclinical endometritis have not been evaluated in the present study. Further histological examination is required to be further investigated.

4.3 Ovulation, weight, size and length of the gilt's reproductive tract

In macroscopically normal genital organs, the weight of the ovaries and the uterus changed according to the reproductive status. In general, the normal ovary of pig weight 3.5-20.0 g and length 3.0-6.0 cm [22]. The weight and length of the ovary in the present study were within the normal length. The weight of the gilt's ovary was slightly lower than ovary of the same breed of the slaughtered sows in Sweden (3.1 g for anoestrus gilts versus 5.2 g for anoestrus sows and 5.1-6.9 for cycling gilts versus 7.6 g for cycling sows) [14]. It has been demonstrated that the weight of ovary as a proportion of bodyweight increased up to 16 week of age and remained constant until puberty [23]. However, the actual weight of the ovaries of pre-pubertal gilts still increased continuously from 16 week of age until 28 week of age follow the increase of the live weight of the gilts [24]. After 28 weeks of age the weight of the ovaries depended on the follicular growth and the reproductive status. In the present study, the minimum age at culling was 211 days (30 week), the increase of the ovarian weight should have been completed. On average, the weight of the ovaries of pre-pubertal gilts was significantly lower than the cycling gilts. Similar trend was also found for the oviducts and the uterine horns. Some factors suppressing the normal growth of the reproductive tissue should be aware because the ADG of these gilts was relatively low. The delayed puberty problems (inactive ovaries) observed in the present study might also associate with the suboptimal growth rate of the reproductive tissue of the gilts.

In general, the normal oviduct length 15-30 cm and the uterus had a short body with a two long uterine horn length up to 150 cm [22]. In the present study, the length of the oviduct and the uterine horn were within the normal length. It has been demonstrated that length of the oviduct of gilts increased from 13.0 cm to 31.8 cm during 10-16 week of age and then remain constant until puberty [23]. After puberty the length of the oviduct was significantly increased [23]. In the present study, the length of the oviduct was also significantly different between pre-pubertal and cycling gilts (Table 7). Little information concerning the pathological and morphological changed of the oviduct in the slaughtered pig is available. Recently, Tienthai et al. [25] found a significant decrease in the epithelial cell high in the utero-tubal junction (UTJ) and ampulla in the gilts culled due to repeat breeding and anoestrus compared to normal cycling sows. The author state that the culling of replacement from swine herd might also involved with the improper function of the oviduct [25]. Further study concerning the function of the oviduct in these slaughter gilts are of interest.

The weight of the uterus in pubertal gilts was about 300-600 g and growth curve of the uterus had spurts of growth at 16 week of age and again at 28 week of age [24]. In the present study, the pre-pubertal uterine weight was 125 g, while the weight of the cycling gilts was about 700 g. This indicated that the weight of uterus was dramatically increased after puberty. The slightly heavier uterine weight in post-pubertal gilts in the present study compared to previous study might be due to the old age of gilts at culling. Dalin et al. [14] demonstrated that the weight of the uterus varied from 141 to 865 g (mean = 408 g) in anoestrus gilts and sows and varied from 380-1530 g (mean=785 g) in gilts and sows that had been cycling. In the present study, the weight

of the cycling gilts was within the range but the uterine weight of the pre-pubertal gilts was lower than anoestrus gilts and sows reported earlier [14]. In the present study, the weight of the uterus did not differ significantly between luteal and follicular phase. Earlier study demonstrated that the length of the uterine horn increased from 10 up to 27 cm from 0 to 6 week of age and significantly increased up to about 60 cm again at 12 week of age and then remained constant until puberty [23]. At puberty the length of the uterine horns increased from 60 cm to 112 cm [23]. In the present study, the length of the uterine horns as well as the uterine body was also significantly increased after puberty. Morphological study on the uterus of the slaughtered gilts needs further investigation.

4.4 Cystic ovary

It has been found that the cystic ovaries account for about 10% of the reproductive problems in sow and gilts sent for slaughter for infertility [26]. In the present study, multiple ovarian cysts were found in 5.2% of the gilts and single ovarian cyst was found in 4.7% of the gilts. Earlier study in Lithuania demonstrated that the multiple ovarian cysts were found in 4.7% of the multiparous sows culled due to reproductive disturbance [15]. In the Swedish sow pool, up to 14% of sows and gilts culled due to reproductive disturbance had multiple ovarian cysts [14]. In live animals, the ovarian cysts was observed in 2.4% of 1990 cyclic sows in commercial swine herd using a real time B-mode ultrasonographic examination [27]. Multiple ovarian cysts without CL was found between 3.2-20% in non-pregnant first served sows [28].

Ovarian cyst in swine can be single, multiple, unilateral, or bilateral. These cysts can be divided into three categories including multiple large cyst, multiple small cysts and single large or small cyst [26]. Ovarian has been found in both pregnant and non-pregnant sows [26]. Sow or gilt with ovarian cyst may be intermittently or permanently in anoestrus or having irregular oestrus (abnormally long, abnormally short or short oestrus). In the present study, one gilt culled due to abnormally long oestrus had a single cystic ovary with 2.0 cm diameter but both ovaries still contained 17 CL (9 on the left and 8 on the right ovary). Based on post-mortem examination, Ebbert and Bostedt [29] demonstrated that cystic ovaries without CL had a larger diameter and volume than cystic ovaries with CL. The number of cysts on cystic ovaries with CL was about twice as high as on the ovaries with CL (23.3 vs 12.1 cysts/sow) [29]. Most of the cystic animals had a combined form of degeneration consisting of both large (>1.5 cm in diameter) and small cyst (<1.5 cm in diameter) [29]. Up to 75% of the cystic ovaries sows with pale or absent CL showed no oestrus activity [29]. In live animals, the existence of follicles with diameter ≥ 2.0 cm for more than 5 days after the onset of oestrus was regarded as cystic ovaries [27]. In the present study, most of culling gilts might have been in the herds for more than 5 days after the oestrus before slaughter. Most of the cystic ovaries observed in the present study had luteinization (85.7%).

The incidence of cystic ovaries in pig was influenced by herd, season and might be related with the presences of zearalenone in feed [13]. The greatest number of ovarian cyst occurs in gilts and sows after farrowing and following weaning [26]. Sows with lactation length shorter than 14 days and sows that had weaning-to-oestrus interval ≤ 3 days had a higher incidence of ovarian cyst [27]. It has been suggested that the cause of ovarian cysts was associated with the deficiency of leutinizing hormone [26,27]. Stress as well as daily administration of ACTH during follicular phase could induce ovarian cyst [26]. In the present study, high proportion of ovarian cyst was found in the gilts culled due to vaginal discharge and repeat mating rather than other reasons. Under farm conditions, Castagna et al. [27] demonstrated that sows with ovarian cyst lead to a high incidence of return to oestrus (34%), high incidence of not-in-pig (10.6%) and low farrowing rate (52.2%). The presence of cystic ovaries in the present study indicated that this problems still be part of the common cause of reproductive failure in gilts, especially those having vaginal discharge and repeat mating problems.

4.5 Delayed puberty

The gilts that had inactive ovaries (pre-puberty) had 27.4%. Since the minimum age at culling was 211 days, these gilts were likely to have delayed puberty problem. Einarsson et al. [30] studied the genital organs of gilts culled due to anoestrus and found that 35.2% of these gilts have not been cycling (pre-puberty). In the present study, it was found that 52.7% of the gilts culled due to anoestrus have not been cycling. In addition, it was found that 41.8% were culled during luteal phase and 5.5% were culled during follicular phase. Earlier study found that 3.7% of gilts culled due to anoestrus were pregnant [30]. In the present study, none of the anoestrus gilts were pregnant. Under field conditions, it is possible that the gilts might be pregnant during oestrus stimulation and acclimatization. In some herds, vasectomized boars were used to avoid this problem and increased the ability of physical boar contact. Nowadays, artificial insemination (AI) have been used in all herds, while the fence line boar contact is normally use among the herds in the present study, the accidental mating problems seem to be minor. Furthermore, the housing of the gilts pool is separated from the breeding house in all herds. The pregnant slaughtered gilts was found in 2.4% of the gilts in the present study with reasons of culling i.e., delayed farrowing, not-in-pig and not-pregnant. Einarsson et al. [30] demonstrated that among the prepubertal gilts, 14/19 gilts had follicle ≥ 5 mm in diameter and 5/19 had follicle < 5 mm. In the present study, the diameter of follicle was measured. It was found that 44/58 (74.9%) had follicle with diameter ≥ 5 mm and 14/58 (24.1%) had follicle with diameter < 5 mm. Delayed puberty led to culling of anoestrus gilts cause an increase of NPD. Earlier study found that the culling gilts loss about 151 NPD [14]. In the present study the period from entry-to-culling in gilts was 96.3 days. This period varied according to reason of culling (see 4.1). Under tropical climate, oestrus as well as oestrus detection of the replacement gilts is of important. Tummaruk et al. [1] found that the proportion of gilts showed oestrus behaviour and ovulated normally was lowest during summer. The high incidence of the inactive ovaries among the culled gilts observed in the present study suggested that proper management, breed, nutrition and housing of the replacement gilts should be investigated.

4.6 Pyometra

In the present study, clinical metritis was observed in 11.5% of the gilts. The major culling reasons of these gilts consisted of abortion, vaginal discharge and not pregnant. Base on earlier histological study, as high as 27% of the genital organs from slaughtered gilts and sows had endometritis problems. However, about 50% of these cases had only a mild degree of the endometritis, which could not be identified macroscopically [14]. It was also found that the anoestrus gilts and sows had a higher incidence of endometritis than cyclic animals (61% versus 19%). In the present study, the gilts that had endometritis have pus exudate in the uterine horns, the gilts that had subclinical or mild degree of endometritis has not been investigated. Further study should be carried out to identify morphological changed of the mild degree endometritis gilts. However, the interpretation for endometritis should be aware, since the lymphocyte subpopulation in the female reproductive tracts was also changed according to the reproductive cycles and hormonal changes [31,32]. Pyometra are in most case caused by bacteria. Bacteria commonly isolated from pyometra in pig included *Staphylococcus aureus*, *Corynebacterium pyogenes*, α -hemolytic *Streptococcus*, *Escherichia coli*, *Pasturella sp.*, *Aeromonas sp.*, *Acinetobacter sp.* and *Citrobacter sp.* [33]. Most of the gilts that had vaginal discharge problems might have been treated with antibiotics and in some case these bacteria might have been eliminated before the gilts were slaughtered. Therefore, only 18.6% of the gilts culled due to vaginal discharge had pyometra. Another possibility might be that vaginitis and vestibulitis might be more common among these slaughtered gilts than pyometra.

4.7 Par-ovarian cyst

The incidence of par-ovarian cyst in the present study (29.7%) was similar to a number of earlier reports. For instance, 22.9% of sows and gilts with many reasons of culling in Finland had par-ovarian cyst [10], par-ovarian cyst was observed in 29.3% of the culled sows in Japan [34] and 14.3% of the slaughtered gilts in Sweden contained par-ovarian cyst [11]. The par-ovarian cyst is generally regarded as normal conditions in pig and not interfere the normal reproductive function. These cysts are the remnant of the mesonephric and paramesonephric duct. It has been demonstrated that more than 85% of par-ovarian cyst had diameter of below 1.0 cm [34]. This is in agreement with the presented study that 81.1% of par-ovarian cyst had diameter lower than 1.0 cm. Earlier study found that with regarded to the location of the cyst, 62.9% of par-ovarian cyst in sow was found in the mesosalpinx, while the same type of cyst usually found in the fimbria in cow [34]. Similar findings were found in gilts in the present study. The number of par-ovarian cyst varied from 1-6 cysts, while the diameter varied from 0.1-2.5 cm. Tsumura et al. [34] investigated par-ovarian cyst from 791 sows from slaughter house but they could not demonstrated the relationship between par-ovarian cyst and the reproductive status and the clinical history of the animals. In the present study, the relationship between par-ovarian cyst and the reproductive status as well as other clinical and macroscopic findings were demonstrated. The incidence of par-ovarian cyst was not related to the presence of pyometra, the congestion of the oviduct, the congestion of the uterine horn. However, gilts with cystic ovaries had a significantly higher incidence of par-ovarian cyst than gilts with normal ovaries. However, par-ovarian cysts were not defined as pathological structure. In rare case, some par-ovarian cyst with diameter ≥ 2 cm located in the fimbria of the oviducts might impair the function of the infundibulum during ovulation [11].

In conclusions, common reproductive failure among the replacement gilts included anoestrus, vaginal discharge and repeat mating. The NPD of the culling gilts was on average 96.3 days. Of these gilts, 72.6% have been cycling, while 27.4% has not reach puberty yet. Of the gilts culled due to anoestrus, 52.7% were pre-puberty. Of all gilts, 50.9% had normal genital organs, while 49.1% had at least one pathological change/ abnormality. The common macroscopic findings included cystic ovaries (10.1%), pyometra (11.5%) and congenital abnormality (7.7%). The present study gives information of the macroscopic findings on the genital organs of reproductive disturbance replacement gilts. This could be useful information for clinical diagnosis and prognosis for the inferior reproductive performance of gilts raised under the tropics. For instance management concerning oestrus detection and oestrus stimulation in the replacement gilts need to be improved.

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Table 1

Descriptive statistics on reproductive parameters of 212 slaughtered replacement gilts from 7 swine herds in Thailand during 2005-2006

Parameters	N	Mean±SD	Range
Age at culling (d)	205	321.3±50.8	211-504
Body weight at culling (kg)	204	145.9±24.2	92-242
Age at entry (d)	167	235.5±39.0	154-365
Age at first oestrus (d)	89	252.1±32.9	181-374
Age at first mating (d)	96	267.9±30.3	204-374
Average daily gain (g/d)	201	457.0±87.5	197.4-688.8
Entry-to-culling (d)	169	96.3±53.5	6-273

Table 2

Average age at culling, age at first observed oestrus, age at first mating, average daily gain from birth to culling (ADG) and non productive day (NPD) in culling gilts by culling reason, number of gilts is presented in bracket

Reason of culling	Age at culling (d)	Age at first oestrus (d)	Age at first mating (d)	ADG (g/d)	NPD (d)
Anoestrus	307.5±44.7 (91)	230.0±42.7 (3)	(0)	456.7±98.1 (91)	101.7±46.4 (65)
Vaginal discharge	304.9±37.6 (43)	245.8±27.7 (31)	270.4±22.5 (26)	454.6±69.1 (43)	61.1±37.7 (36)
Repeat mating	339.6±56.4 (29)	258.1±30.0 (20)	265.8±31.0 (28)	466.9±83.7 (28)	108.3±64.4 (26)
Not pregnant	370.6±42.5 (17)	259.5±33.6 (13)	263.4±27.3 (17)	416.4±71.6 (14)	132.1±47.8 (17)
Abortion	315.5±32.2 (17)	245.0±26.3 (15)	259.9±31.2 (17)	484.9±82.8 (17)	68.4±33.7 (17)
Not-in-pig	442.8±27.7 (4)	303.3±79.0 (3)	320.3±42.9 (4)	401.5±76.6 (4)	191.3±30.3 (4)
Delayed farrowing	382.7±14.6 (3)	239.7±23.7 (3)	254.3±14.0 (3)	527.5±77.2 (3)	141.0±4.4 (3)
Long oestrus	332.0 (1)	287.0 (1)	309.0 (1)	420.2 (1)	34 (1)
Total	321.3±50.8	252.1±32.9	267.9±30.3	457.0±87.5	96.3±53.5

Table 3

Percentage of gilts classified by culling reasons in relation to the reproductive status

Reason of culling	No. of gilt	% of gilt	Reproductive status (%)			
			Prepuberty	Follicular	Luteal	Pregnant
Anoestrus	91	43.7	48 (52.7)	5 (5.5)	38 (41.8)	0
Vaginal discharge	43	20.7	4 (9.3)	11 (25.6)	28 (65.1)	0
Repeat mating	32	15.4	1 (3.1)	7 (21.9)	24 (75.0)	0
Not pregnant	17	8.2	4 (23.5)	2 (11.8)	10 (58.8)	1 (5.9)
Abortion	17	8.2	0	5 (29.4)	12 (70.6)	0
Not-in-pig	4	1.9	0	0	3	1
Delayed farrowing	3	1.4	0	0	0	3
Long oestrus	1	0.5	0	0	1	0
Total	208	100	57 (27.4)	30 (14.4)	116 (55.8)	5 (2.4)

Table 4

Pathological findings and/or abnormalities in the reproductive tract of the culling replacement gilts in relation to reason of culling

Reason of culling	Number of pathological change and/or abnormalities/number of gilt					
	Ovary	Oviduct	Uterus	Cervix	Vagina ²	UB ³
Anoestrus	10/91	4/91	11/91 ^a	3/90 ^b	9/90	5/90
Vaginal discharge	10/43 ^a	2/43 ^b	10/43 ^a	11/43 ^a	10/43	6/43
Repeat mating	9/32 ^a	2/32 ^b	6/32	9/32 ^a	7/28	3/28
Not pregnant	1/17 ^a	0/17	7/17 ^b	4/16	4/15	2/15
Abortion ¹	1/17	0/17	6/17	5/17	4/17	1/17
Not-in-pig ¹	0/4	1/4	3/4	2/4	0/4	1/4
Delayed farrowing ¹	0/3	0/3	3/3	0/3	0/3	1/3
Long oestrus ¹	1/1	0/1	0/1	0/1	0/1	0/1
Total	32/208 (15.4%) ^{ac}	9/208 (4.3%) ^b	46/208 (22.1%) ^a	34/206 (16.5%) ^a	34/201 (16.9%) ^a	19/201 (9.5%) ^c

^{a, b, c} different superscripts within row differ significantly ($P \leq 0.05$); ¹ data were not included in the statistical models; ²Vagina and vestibule; ³UB=Urinary bladder

Table 5

Incidence of cystic ovaries, pyometra and congestion of the uterus and oviducts in the reproductive tract of the culling gilts in relation to reason of culling

Reason of culling	Cystic ovaries ¹	Pyometra ¹	Uterine congestion ²	Oviduct congestion ²
Anoestrus	5/91 (5.5) ^a	5/91 (5.5) ^a	14/80 (17.5)	5/87 (5.8)
Vaginal discharge	8/43 (18.6) ^b	8/43 (18.6) ^b	11/33 (33.3)	5/41 (12.2)
Repeat mating	5/32 (15.6) ^{ab}	4/32 (12.5) ^{ab}	4/26 (15.4)	5/30 (16.7)
Not pregnant ³	1/17 (5.9)	3/17 (17.7)	3/10 (30.0)	2/17 (11.8)
Abortion ³	1/17 (5.9)	4/17 (23.5)	5/11 (45.5)	1/17 (5.9)
Others ³	1/8 (12.5)	0/8 (0)	1/2 (50.0)	0/7 (0)
Total	21/208 (10.1%)	24/208 (11.5%)	38/162 (23.5%)	18/199 (9.1%)

¹proportion of the abnormality per total number of the gilts; ²proportion of the abnormality per number of the gilts with macroscopically normal; ³Data were not included in the statistical model;

^{a, b} different superscript within column differ significantly

Table 6

Comparison of number of corpora lutea, corpora albicans, follicles, ovarian weight, length of the oviduct and length of the uterine horns between left and right sides within animal

Reproductive parameters	Number of gilt	Left	Right	Difference ¹	P-value
Number of corpora lutea	105	8.2±2.9	7.8±3.4	0.3	0.51
Number of corpora albicans	88	8.1±3.6	7.5±3.5	0.6	0.17
Number of follicles (≥5 mm)	127	11.1±6.1	10.5±5.3	1.0	0.02
Ovarian weight (g)	179	5.6±2.9	5.3±2.9	0.3	0.03
Length of oviduct (cm)	201	28.2±7.1	26.3±6.4	1.9	<0.001
Length of uterine horn (cm)	166	107.4±41.5	105.9±40.9	1.6	0.13
Par-ovarian cyst	212	12	24	12	-

¹ Mean of the difference between left and right sides within animal (left-right)

Table 7

Weight and size of ovary, length of oviduct and proportion of par-ovarian cysts from culling gilts in relation to the reproductive status

Reproductive status	Ovary			Oviduct		Par-ovarian cyst ²
	N	Weight (g)	Size ¹ (cm)	N	Length (cm)	
Pre-puberty	58	3.1 ^a	1.8x2.6	57	20.8 ^a	10/58 (17.2%) ^a
Follicular	27	5.1 ^b	1.9x3.1	27	31.7 ^b	7/31 (22.6%) ^{ab}
Luteal	89	6.9 ^c	2.3x3.4	112	29.5 ^c	46/118 (39.0%) ^b
Pregnant	5	8.4 ^c	2.6x3.9	5	25.0 ^{ac}	0/5 (0%) ³
Total	179	5.5	2.1x3.1	201	27.2	63/212 (29.7%)

¹ size of the ovary present as wide (cm) x length (cm); ² Proportion of par-ovarian cyst per total number of ovary and number in the parenthesis is the percentage; ³ data were not included in the statistical model; ^{a, b, c} different superscripts within column differ significantly ($P \leq 0.05$)

Table 8

Weight and length of macroscopically normal uterus of culling gilts in relation to the reproductive status and the body weight (kg) of the gilts

Reproductive status	N	Body weight (kg)	Weight of uterus (g)	Uterine horn (cm)		Body of uterus (cm)	Total length ¹ (cm)
				Left	Right		
Pre-puberty	49	133.1 ^a	125.8 ^a	61.7 ^a	60.8 ^a	2.6 ^a	125.0 ^a
Follicular	19	143.1 ^{ab}	684.4 ^b	99.8 ^b	94.8 ^b	3.7 ^b	198.3 ^b
Luteal	90	150.3 ^b	707.9 ^b	132.8 ^c	131.7 ^c	4.1 ^b	268.6 ^c
Total	158	144.1	531.9	107.4	105.9	3.6	216.9

^{a, b, c} different superscripts within column differ significantly ($P \leq 0.05$)

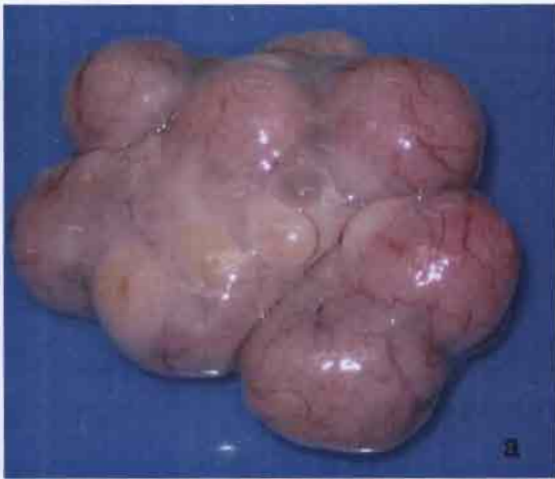


Fig 1 Normal ovary Luteal phase (a) Follicular phase (b)



Fig 2 Inactive ovary of the delayed pubertal gilts (a) and multiple cystic ovaries (b)



Fig 3 Ovarian adhesion



Fig 4 Unilateral small ovary



Fig 5 Hydrosalpinx



Fig 6 Par-ovarian cyst



Fig 7 Salpinxgitis



Fig 8 Unilateral true hermaphrodite



Fig. 9 Histopathology of the ovo-testis

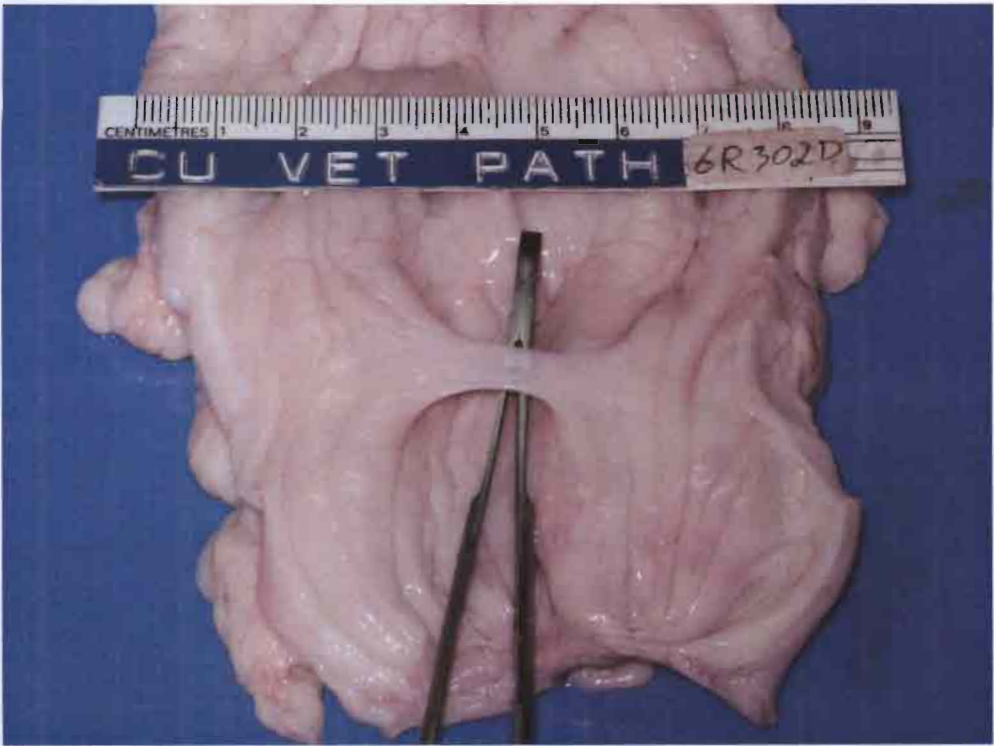


Fig 10 Persistent hymen



Fig 11 Pyometra and cervicitis



Fig 12 Segmental aplasia of the uterine horn



Fig 13 Congestion of the uterine horn



Fig 14 Edema of the uterus



Fig 15 Cystitis

Output ที่ได้จากโครงการวิจัยที่ได้รับทุนจาก สกว.

1. เรื่องสันติพิมพ์ในการประชุมวิชาการระดับนานาชาติ 2 เรื่อง และ ผลงานวิจัยเพื่อส่งตีพิมพ์ในวารสารวิชาการระดับนานาชาติ 1 เรื่อง

1. Tummaruk, P., Kedsangsakonwut, S., Kunavongkrit, A. 2007. Post-mortem examination on the genital organs of gilts culled due to reproductive failure. Proc. 3rd Congress of the Asian Pig Veterinary Society. P.422.
2. Kedsangsakonwut, S., Tummaruk, P., Srisuwatanasagul, S. 2007. Congenital abnormalities of the reproductive organs in the slaughtered gilts. Proc. 3rd Congress of the Asian Pig Veterinary Society. P.421.
3. Tummaruk, P., Kedsangsakonwut, S., Kunavongkrit, A. 2007. Post-mortem examination on the genital organs of the replacement gilts culled due to reproductive failure. (Manuscript)

2. การนำผลงานวิจัยไปใช้ประโยชน์

เชิงพาณิชย์ การตรวจความผิดปกติเหล่านี้จะเป็นข้อมูลสำหรับเกษตรกร และสัตวแพทย์ ในการวิเคราะห์ปัญหาทางระบบสืบพันธุ์ของสุกรสาวทดแทนในฟาร์มสุกรเพื่อลดการสูญเสีย ที่อาจเกิดขึ้นในอุตสาหกรรมการผลิตสุกร

เชิงนโยบาย เกิดแนวทางในการจัดการสุกรสาวที่เหมาะสม เพื่อลดปัญหาที่พบในการวิจัยครั้งนี้ เช่น การเพิ่มมาตรการการกระตุ้นการเป็นสัดในสุกรสาวก่อนใช้งาน เป็นต้น

เชิงสาธารณะ การนำผลการวิจัยไปขยายผลในศาสตร์ที่มีความใกล้เคียงกัน เช่น กายวิภาคศาสตร์ พยาธิวิทยา เป็นต้น

เชิงวิชาการ ทำให้มีแนวทางการทำวิจัยในแนวลึกต่อเนื่อง เพื่อประโยชน์แก่วิชาชีพสัตวแพทย์

3. อื่น ๆ

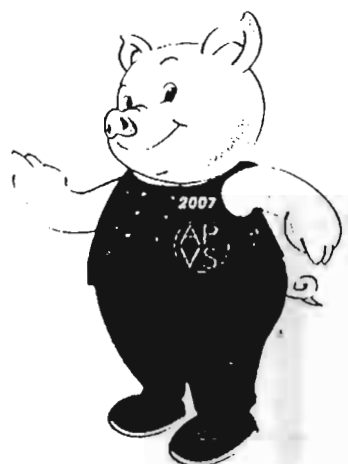
นำเสนอผลงานวิจัยในรูปแบบ Poster ที่ การประชุมวิชาการระดับนานาชาติ 3rd Congress of the Asian Pig Veterinary Society เมือง Wuhan ประเทศ สาธารณรัฐประชาชนจีน ระหว่างวันที่ 22-25 เมษายน 2007 จำนวน 2 เรื่อง

ภาคผนวก

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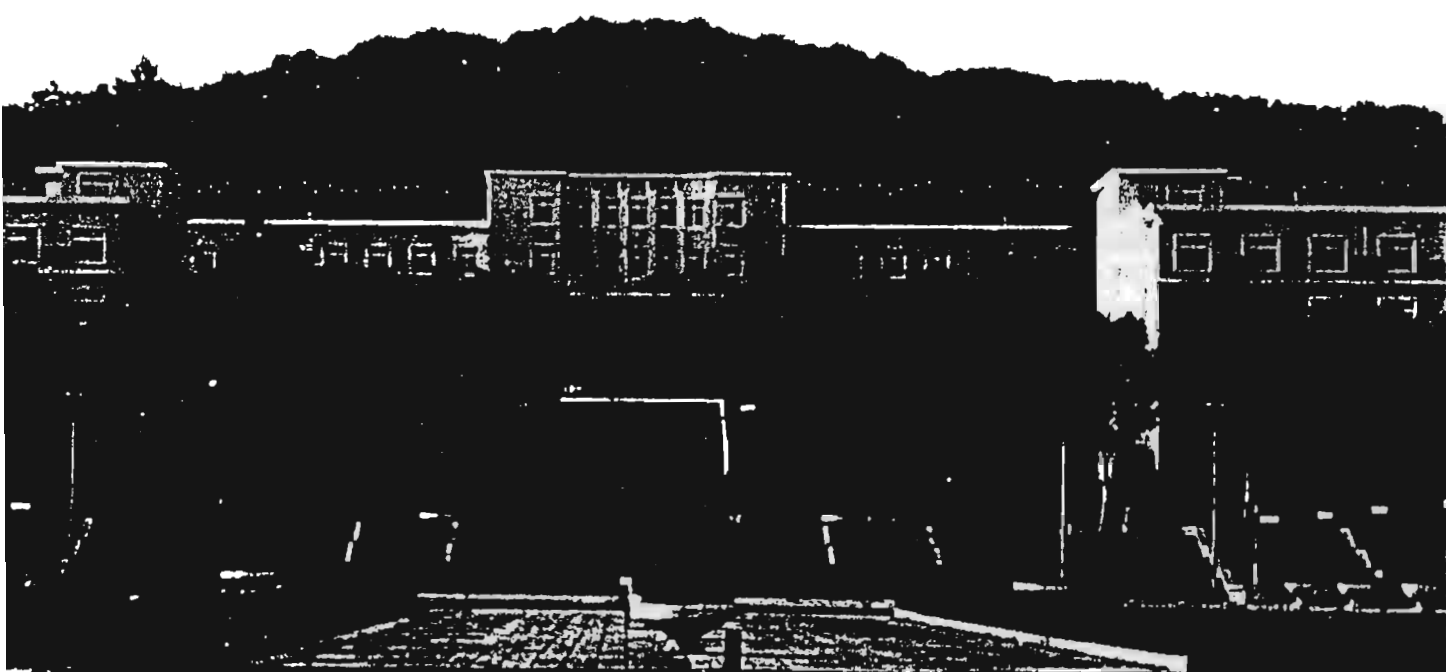
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Post-Mortem Examination On The Genital Organs Of Gilts Culled Due To Reproductive Failure Padet Tummaruk¹

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Keywords: Pig, Reproduction, Ovary, Uterus

Introduction

In general, 35-55% of the sows in the herd are replaced by gilts annually (1). In practice, a certain number of gilts were culled before the first litter was completed, due to various causes such as leg problems and reproductive failure (2). The investigation on gilts that were culled due to reproductive problems is necessary for veterinarian and pig's farmer to overcome the problems. The objective of the present study was to investigate reproductive organs of gilts that were culled due to reproductive failure from 7 commercial swine herds in Thailand.

Material and Methods

The experiment was carried out during July 2005-June 2006. Two hundred twelve samples of the reproductive organs from 4 Landrace (L), 4 Yorkshire (Y) and 203 crossbred Landrace x Yorkshire (LY) gilts were collected from 7 swine herds in Thailand. History taking for all gilts was collected. The culling reasons were analyzed. Macroscopic examination was performed on each part of the reproductive organs within 48 h after culled. The investigation focused on the length, the weight and the abnormality of the ovaries, oviducts, uterine horns, uterine body, cervix, vagina, vestibule and vulva lips. Samples of the uterine horns, uterine body, cervix and vagina were submitted for histopathological examination. The statistical analyses were performed using SAS version 9.0. Descriptive statistics (means, standard deviation and range) and frequency table were conducted for all reproductive parameters. Pair *t*-test was used to compare the number of ovulation, length of the uterine horns and length of the oviducts within animal. $P < 0.05$ was considered as statistical significance.

Results and Discussion

The present study revealed that the culling reasons of gilts that had reproductive failure included anoestrus (42.8%), vaginal discharge (20.7%), repeat mating (15.4%), abortion (8.2%), not pregnant (8.2%), not-in-pig (1.9%) and miscellaneous (2.8%). On average, the gilts were culled at 321.3 ± 50.8 days of age with a body weight of 145.9 ± 24.2 kg (92-242 kg). Of these slaughtered gilts, 45% have been mated, while only 42% had the record of first oestrus before mating. On average, the age at first observed oestrus was 252.1 ± 32.9 days and the age at first mating was 267.9 ± 30.3 days (Table 1). Earlier studies demonstrated that replacement gilts in Thailand shows first standing oestrus at 205 day of age and were inseminated for the first time at about 265 days of age (3, 4). The age at first observed oestrus of the slaughtered gilts in the present study was relatively high compare to the average level in Thailand, while the age at first mating was rather similar. The macroscopic examination of the ovaries and the uterine horns revealed that 55.6% of the gilts were culled during the luteal phase (dioestrus), 27.4% were culled before puberty, 14.2% were culled during follicular phase (pro-oestrus and oestrus) and 2.4% were culled during pregnant.

Of these gilts, 63 % had been ovulated with the present of the corpus luteum (CL), 54% could be observed for the CL of the previous cycle and 75% of the gilts had follicle with diameter of 3-15 mm. presented on the ovaries. On average, the number of ovulation of the gilts was 15.7 ova and the number of ovulation of the previous reproductive cycle was 15.5 ova (Table 1). The length of uterine horns of the gilts on the left side was 111.2 cm and on the right side was 108.3 cm ($P > 0.05$, Table 1). The weight of uterus was 608.2 g. The length of oviducts of the gilts on the left side was 28.2 cm and on the right side was 26.3 cm. The length of the cervix, the vagina and the vestibule were 18.6, 11.5 and 9.4 cm, respectively (Table 1).

In conclusions, common reproductive failure among the replacement gilts included anoestrus, vaginal discharge and repeat mating. Of these gilts, 72.6% have been cycling, while 27.4% has not reach puberty yet. These data suggested that oestrus detection as well as oestrus stimulation in the replacement gilts should be concerned.

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Parameters	N	Mean±SD	Range
Age at culling (day)	205	321.3±50.8	211-504
Age at first oestrus (day)	89	252.1±32.9	181-374
Age at first mating (day)	96	267.9±30.3	204-374
Number of ovulation	130	15.7±3.8	4-27
Number of ovulation of previous cycle	109	15.5±5.8	3-32
Weight of the uterus (g)	210	608.2±442.0	50-2928
Length of the uterine horns (cm.)			
- Left	212	110.7±42.4	35-248
- Right	212	107.9±41.9	13-282
Length of the oviducts (cm.)			
- Left	210	27.8±6.9	14-43.5
- Right	211	26.3±6.5	3-43
Length of the cervix (cm.)	210	18.6±4.1	5-27.5
Length of the vagina (cm.)	208	11.5±3.2	4-25.5
Length of the vestibule (cm.)	197	9.4±1.7	4-18.5

Table 1 Descriptive statistics of the reproductive parameters/organs from 212 gilts culled due to reproductive failure from 7 commercial herds in Thailand during 2005-2006



Congenital Abnormalities Of The Reproductive Organs In The Slaughtered Gilts

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Introduction

Congenital abnormality of the genital organs is one of the reproductive disorders in female pigs. These abnormalities may affect the female reproductive performance (1). The incidence of these problems have been reported between 5-22.1% both in domestic and wild pigs (2-5). Earlier studies showed that cystic formation of the mesosalpinx was the most common defect observed both in gilts and sows (2). In addition, true hermaphrodite was also found occasionally (1). This report describes the gross and histopathological abnormalities of the female genital organs from culled gilts in Thailand.

Materials and methods

The experiment was carried out during July 2005-June 2006. Two hundred twelve female genital organs were collected from 7 commercial swine herds in Thailand. The genital organs were derived from gilts that were culled due to reproductive failure. Post-mortem examination was performed on each part of the reproductive organs within 48 h after culled. The investigation focused on the incidence of congenital abnormalities in the slaughtered gilts. Gross and histopathological lesions of all genital organs were examined.

Results and Discussions

Slaughtered gilts with the reproductive failure (i.e., anestrus, vaginal discharge, etc.) had 32.5 % incidence of congenital abnormalities of the genital organs, higher than previous reports (2,5). The details and percentage of gross lesions of the congenital abnormalities of the genital organs are summarized in Table 1. Similar to the previous report, cyst of the oviduct and mesosalpinx were the most common defect found in this report (2). Other congenital defects included partial aplasia of the uterine horn and uterine unicornis. These defects of the uterine horn directly affect the pregnancy rate and parturition process (1-5). Interestingly, one gilt culled due to anoestrus had unilateral true hermaphrodite, characterized by ovo-testis of the right gonad and the left intact ovary. The problem of anestrus in this gilt may be due to the hormonal imbalance of the congenital abnormalities of the reproductive organs (1).

Table 1 Gross lesions of the congenital abnormalities in the slaughtered gilts

Lesions	Number	Percentage
Cyst of the oviduct and mesosalpinx	57	26.9
Segmental aplasia of the uterine horn with hydrometra	4	1.9
Uterine unicornis	1	0.5
Double uterine body	1	0.5
Diverticulum at the uterine horn	1	0.5
Segmental double uterine horn	1	0.5
Segmental aplasia of the oviduct	1	0.5
Unilateral true hermaphrodite	1	0.5
Double vagina	1	0.5
Vaginal aplasia	1	0.5

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