日本の生産農場における未経産豚と経産豚の安楽死

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Original article

Euthanasia for Gilts and Sows on Japanese Commercial Farms

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Summary

The objective of the present study was to determine euthanasia rate and euthanasia risk, and to compare removal patterns between euthanized females and the other females on Japanese commercial farms. The present study was conducted by using lifetime record data of 62,742 females born between 2001 and 2004 on 101 farms. Linear mixed-effects models were performed to compare lifetime measurements. Of the 101 farms, 25 (24.8%) had records of euthanized females. At the farm level, the mean proportion of removed females that had been euthanized (±SEM) on the 25 farms was 1.27±0.38% with a range between 0.06 and 8.44%. At the individual female level, of the 21,094 females on the 25 farms, the proportions of removed females that were euthanized, dead, or culled were 1.7, 9.7, and 88.6%, respectively. Annualized euthanasia rate was 0.63%. Of the 348 euthanized females, 53.7 and 25.0% were euthanized due to downer and locomotor problems, respectively. Mean values of parity at removal and female life days in the euthanized females were 3.3±0.13 and 717.2±18.58 days, respectively. Euthanized females had lower parity at removal and shorter female life days than culled females ($P<0.05$), but had similar values to dead females. Euthanasia risks in parity 0, 1, and 2 were 0.23, 0.27, and 0.23%, respectively. As parity increased from 3 to ≥6, the euthanasia risks increased from 0.22 to 0.59%. The percentages of sows euthanized at week 0, 1, and 2 after the last farrowing were 2.7, 21.6, and 8.4%, respectively. In conclusion, few females were euthanized on commercial farms in Japan. The removal pattern of the euthanized females was similar to that of dead females. It is ethical to euthanize a female that is immobilized due to severe lesion or other problems rather than waiting for the female to die.

Keywords : death, euthanize, mortality, survival, well-being

Introduction

Euthanasia for female pigs (females) has been practiced on commercial farms to alleviate a concern for animal well-being in U.S.A. and E.U.[10]. When a pig becomes ill, injured, or otherwise disadvantaged, the initial decision for action may include treatment or euthanasia[11]. In some cases, euthanasia may be the best option for the well-being of the pig[11]. In Sweden, euthanasia has been well practiced because of the animal welfare legislation, which states that only females in normal body condition and without lameness are allowed to be transported to slaughter[6]. In fact, the proportion of euthanized sows on commercial farms was 10.5%, which was higher than the 4.3% of dead sows[5]. In U.S.A., the proportions of euthanized and dead females on commercial farms were 6.3 and 8.2%, respectively[1]. Reasons for euthanasia were commonly due to locomotor problems such as leg weakness or lameness[3]. In Japan, a previous study reported that mortality risk was 9.9%[16], but no study has been reported rate and risk of euthanasia for females or reasons for euthanasia on commercial farms.

Previous researches[1,5] reported that approximately half of the euthanized sows and dead sows were removed within 4 weeks after farrowing, whereas most cullings occurred on 4 weeks or later after farrowing. No study has compared the removal pattern of the three removal types (i.e. euthanasia, death, and culling) on commercial farms in Japan. In addition, few studies have investigated lifetime performance of euthanized females.

The objective of the present study was to determine euthanasia rate and euthanasia risk, and to compare lifetime performance and removal patterns between the euthanized females and the other females on commercial farms in Japan.

Materials and methods

Data and Selection Criteria

Data were extracted from an existing database (Meiji University, Kawasaki, Japan), which had been constructed in the following manner. Approximately 130 farms using a recording soft-

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ware (PigCHAMP Inc., Ames, IA, USA) in Japan were requested to mail their data files to the university each time they renewed their yearly maintenance contract. By August 31, 2008, 120 farm producers had sent their data files to the university. Of these 120 farms, data from 19 farms were not used in the present study because seven farms were fattening farms and 12 farms had no record of birth dates or inaccurate records. Lifetime records of females born from 2001 to 2004 were extracted from each data file of the 101 farms and used in the current study. The records of 66,550 females on the 101 farms were observed until female removal in this longitudinal study. Of the 66,550 females, 3,808 (5.7%) were excluded from the analysis of the lifetime performance, but were included for the calculation of euthanasia rate and euthanasia risk. Those females were transferred (n = 594), type-unrecorded (n = 323), or still alive (n = 2,891).

Farms and animals

Average female inventory (± SEM) on the 101 farms was 378 ± 50.4 females, ranging between 25 and 3,304 females. Mean values of culling rate and replacement rate were 39.2 ± 0.80 and 47.7 ± 0.69%, respectively. The data collected in the present study included 1.5% of all farms in Japan, comprising approximately 4% of female inventories in Japan. Replacement gilts were either home-grown crossbreds (Landrace x Large White) or purchased from outside breeding companies.

Definitions and Categories of Measurements

Removal types included euthanasia, death, and culling. Producers have been requested to record one of the three types when a female is removed from their farms. Females included gilts and sows : a gilt is defined as a female that has entered a farm but has not farrowed, and a sow is a female that has farrowed at least once. Annualized euthanasia rate was calculated as the number of euthanized females divided by the sum of life days in all females, multiplied by 365 days. Euthanasia risk was measured by using population at risk as the denominator[7]. Euthanasia risk (%) was calculated as the number of euthanized females divided by the number of surviving females at each parity, multiplied by 100.

Lifetime performance included annualized lifetime PBA, lifetime PBA, lifetime NPD, parity at removal, and female life days. Annualized lifetime pigs born alive (PBA) was used as an indicator of lifetime efficiency, which was calculated as lifetime PBA divided by female life days, multiplied by 365 days[17]. The female life day was defined as the number of total days from the birth date to the removal date. Herd life day was defined as the number of days from the date that a gilt was first mated, to her removal date. Lifetime nonproductive days were defined as the number of days when a female was neither gestating nor lactating during her reproductive herd life[12].

Parity 7 or higher were categorized into Parity 6. Reasons for euthanasia were grouped into five categories: downer, locomotor problems, peripartum problems, uterine or vaginal prolapse, or unknown.

Statistical Analysis

All statistical analyses were performed with SAS software, version 9.1 (SAS Inst. Inc., Cary, NC). A Chi-square test was used to compare the relative frequencies of the number of weeks after the last farrowing to removal, by the removal type. The proportions of removed sows were compared with the two-sample test for binomial proportions[13] for each week, by using euthanized sows as the reference. A linear mixed-effects model using the MIXED procedure was used to compare lifetime performance between the removal types. Tukey-Kramer post-hoc multiple comparisons were used to compare the mean of measurements between the removal types. The dependent variable was lifetime performance, and the independent variable was the removal types. Farm and birth year were included as random effects in the model.

Results

Of the 101 farms, 25 (24.8%) had euthanized females (Table 1). At the farm level, mean proportion of removed females that had been euthanized (± SEM) on the 25 farms was 1.27 ± 0.38% with a range between 0.06 and 8.44%. At the individual female level, of the 21,094 removed females on the 25 farms, the proportions of removed females that were euthanized, dead, or culled were 1.7, 9.7, and 88.6%, respectively. Meanwhile, the proportions of dead and culled females on the 76 farms (41,648 females) with no euthanized females were 10.2 and 89.8%, respectively (Table 1). The following analyses were done on the 21,094 females on the 25 farms having euthanized females.

Annualized euthanasia rate was 0.63%. Table 2 shows relative frequency (%) of reasons for euthanasia in the 348 euthanized females. Of the 348 euthanized females, 53.7 and 25.0% were euthanized due to downer and locomotor problems, respectively. A few females were euthanized due to peripartum problems (2.0 %), or uterine or vaginal prolapse (0.9%).

Mean values (± SEM) of parity at removal, female life days, and annualized lifetime PBA in the 21,094 females were 4.5 ± 0.01, 917.5 ± 1.56 days, and 18.5 ± 0.03 pigs, respectively. Euthanized females had fewer annualized lifetime PBA, fewer lifetime PBA, and low parity at removal than culled females ($P < 0.05$; Table 3), but had similar values to dead females.

Table 4 shows euthanasia risks by parity. Euthanasia risks in parity 0, 1, and 2 were 0.23, 0.27, and 0.23%, respectively. As the parity increased from 3 to ≥6, the euthanasia risks increased from 0.22 to 0.59%.

Figure 1 shows the relative frequencies (%) of removed sows against the number of weeks from the last farrowing to removal, by removal type. The frequency of euthanized sows did not differ from that of dead sows, but differed from that of culled sows ($P < 0.05$). The percentages of removals due to euthanasia during week 0, 1, and 2 after the last farrowing were 2.7, 21.6, and 8.4%, respectively, whereas the percentage of dead sows were 9.8, 24.1,

Table 1 Relative frequency (%) of euthanized, dead, and culled females by farm groups based on whether or not a farm had euthanized females

	All		Farm groups			
			Farms having euthanized females (25 farms)		Farms having no euthanized females (76 farms)	
Removal type	n	%	n	%	n	%
Euthanasia	348	0.6	348	1.7	0	0
Death	6,280	10.0	2,053	9.7	4,227	10.2
Culling	56,114	89.4	18,693	88.6	37,421	89.8

Frequencies in each column add up to 100%.

Table 2 Relative frequency (%) of reasons for euthanasia in 348 euthanized females on 25 farms

Reason for euthanasia	n	%
Downer	187	53.7
Locomotor problems[1]	87	25.0
Peripartum problems[2]	7	2.0
Uterine or vaginal prolapse	3	0.9
Unknown[3]	64	18.4

[1] Locomotor problems include joint infection, unsoundness, hernia, and laceration.

[2] Peripartum problems include difficult farrowing, retained pigs, mummified litter, and mastitis.

[3] Unknown includes no record, unthrifty, rectal prolapse, accident, off feed, abortion, did not conceive, central nervous, gastrointestinal, and hemorrhagic bowel.

and 11.1%, respectively. In contrast, the percentages of removals due to culling during week 0, 1, and 2 after the last farrowing were 0.1, 1.3, and 2.6%, respectively.

Discussion

The present study is the first report on euthanasia for gilts and sows on commercial farms in Japan. The present study revealed that a few farms, only 24.8%, had performed euthanasia on gilts and sows, and that only 1.7% of all removed females had been euthanized. The proportion of euthanized females on the selected farms in Japan is fewer than in other countries, such as 6.3% in U.S.A.[1] and 10.5% in Sweden[5]. Swine producers in Japan might not make a decision to cull or euthanize a female in a timely manner, and some producers might not consider euthanasia as an option for well-being. Euthanasia is not an animal well-being problem if it is performed adequetly[18]. On-farm education should be conducted to help producers and caretakers understand and implement some euthanasia protocols on the farm[10]. The American Association of Swine Veterinarians recommends that producers and their employees discuss the options with their veterinarians and make an action plan for euthanasia[11]. In addition, it is crucial to practice euthanasia by humane methods with minimal pain and distress to the pigs and rapid loss of sensitivity[11]. Recommended methods for humane on-farm euthanasia of swine in North America include carbon dioxide inhalation, a penetrating or non-penetrating captive bolt shot, head-to-heart electrocution, and anesthetic overdose administration. Additionally, it is important to confirm that the pig has been euthanized effectively by checking its vital signs.

The present study showed that approximately 80% of the euthanized females were removed due to downer or locomotor problems, and these are consistent with previous studies in U.S.A. and E.U.[1,3,5]. A removal due to downer or locomotor problems has increased an ethical concern for animal well-being because the females must endure pain until removal[9]. It is recommended for producers to euthanize or cull females that show inadequate improvement or that have minimal prospect for improvement after two days of intensive care[11]. In order to timely euthanize a female, day-to-day observations by caretakers will help determine which animals warrant a treatment and which should simply be euthanized[14].

The present study showed that euthanized females had a removal pattern similar to dead females. Additionally, we found higher euthanasia risk in parity 1 and $\geq$6 than those in parity 2 and 3, whereas higher mortality risks in parity 1 and $\geq$5 were reported than those in parity 2 and 3[16]. Results of the present study and previous reports[4,16] indicate that females in the peripartum period are at high risk for euthanasia and death. A high proportion of euthanized and dead sows may elevate a concern for animal well-being[5]. Increased care for maternal health in the peripartum period in the farrowing barns[19] would decrease the number of deaths of females and alleviate concerns for the well-being of females. In addition, supervision and assistance to sows and piglets during peripartum periods results in a reduction of piglet mortality[8]. In order to assist a sow's farrowing, it is useful to predict the date of farrowing by using the records of previous gestation length[15].

In the present study the lower lifetime performance in eutha-

Table 3 Comparisons of lifetime performance between removal types on 25 farms

	Removal type					
	Euthanasia		Death		Culling	
Measurement	n	Mean ± SEM	n	Mean ± SEM	n	Mean ± SEM
Annualized lifetime PBA	297	17.7 ± 0.37b	1,742	15.9 ± 0.15b	16,575	18.8 ± 0.05a
Lifetime PBA	297	42.2 ± 1.51b	1,742	39.0 ± 0.56b	16,575	56.0 ± 0.21a
Lifetime NPD	314	64.2 ± 3.38ab	1,924	75.5 ± 1.54b	17,699	77.8 ± 0.48a
Parity at removal	348	3.3 ± 0.13b	2,053	3.2 ± 0.05b	18,693	4.6 ± 0.02a
Female life days	348	717.2 ± 18.58b	2,053	738.5 ± 7.47b	18,693	937.2 ± 2.67a

The abbreviations: pigs born alive (PBA) and nonproductive days (NPD) were used.
[a,b] Within a row, means without a common letter differed ($P < 0.05$).

Table 4 Euthanasia risk by parity on 25 farms

	Number of females in each parity			
Parity	Surviving	Removed	Euthanasia	Euthanasia risk[1], %
0	21,979	2,480	51	0.23
1	19,499	2,088	52	0.27
2	17,411	1,399	40	0.23
3	16,012	1,427	35	0.22
4	14,585	1,608	54	0.37
5	12,977	2,000	51	0.39
≥6	10,977	10,092	65	0.59
Total	21,979	21,094	348	1.58

[1] Euthanasia risk was calculated as the number of euthanized females divided by the number of surviving females in each parity.

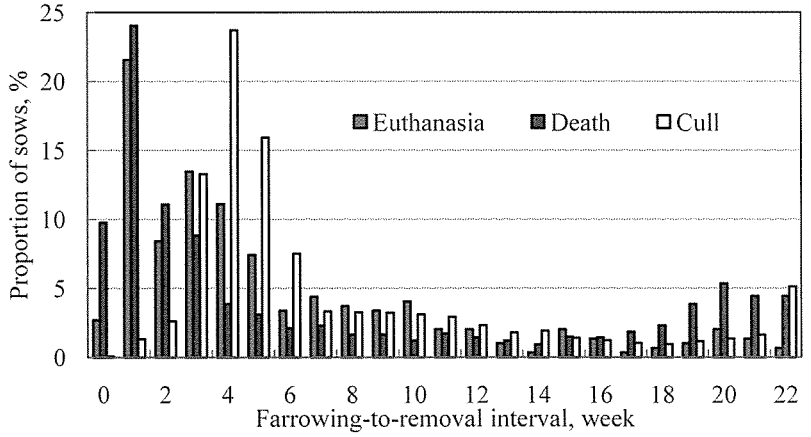

Fig. 1 Relative frequencies (%) of the 21,094 removed sows against the number of weeks from the last farrowing to removal, by removal type on 25 farms

nized and dead females compared with culled females could be explained by the low parity at removal in the euthanized and dead females. A previous study has reported that less severe form of lameness, which was one of the most common reasons for euthanasia in the present study, can affect the performance of sows and indirectly lead to sow removals[2]. Timely and proactive culling of sows may decrease the proportions of death and euthanasia and improve lifetime performance of the farm.

In conclusion, few females were euthanized on commercial farms in Japan. Removal pattern and reproductive performance of the euthanized females were similar to those of dead females. It is ethical to euthanize a female that is immobilized due to lesion or other problems rather than waiting until the female dies.

It is noteworthy that the present study was not a controlled experiment, but an observational study using records from commercial farms. Thus, the findings in the present study should be interpreted only as an association, not as indicators of biological causation. In addition, the farms in the present study were not randomly selected, therefore, the findings in the present study may not apply to all swine farms in Japan. Even with these limitations, the current study clarifies valuable information on swine euthanasia on commercial farms in Japan.

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原　著

日本の生産農場における未経産豚と経産豚の安楽死

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要旨

本研究の目的は，日本の生産農場における雌豚の安楽死率と安楽死リスクの測定，安楽死された雌豚とその他の雌豚における淘汰パターンの比較とした。本研究では，101農場における2001年から2004年に出生した62,742頭の雌豚における生涯記録を用いた。101農場のうち，25農場(24.8%)が安楽死を行っていた。この25農場において，安楽死雌豚の農場平均割合（±標準誤差）は1.27±0.38%であり，幅は0.06%から8.44%であった。この25農場における21,094頭の雌豚では，安楽死，死亡，淘汰雌豚の割合は，それぞれ1.7%，9.7%，88.6%であった。安楽死雌豚の平均淘汰産次と生涯生存日数は3.3±0.13産，717.2±18.58日であった。年間安楽死率は0.63%であった。安楽死雌豚348頭のうち，53.7%が起立不能，25.0%が四肢障害という理由によって安楽死されていた。安楽死雌豚は，淘汰雌豚よりも淘汰産次が低く，生涯生存日数が短かったが（$P<0.05$），死亡雌豚とは差がみられなかった。産次0，1，2の安楽死リスクは，それぞれ0.23%，0.27%，0.23%であった。産次が3から6以上に上がると，安楽死リスクは0.22%から0.59%に上がった。分娩後0，1，2週における雌豚割合は，安楽死雌豚が2.7%，21.6%，8.4%，死亡雌豚が9.8%，24.1%，11.1%，淘汰雌豚が0.1%，1.3%，2.6%であった。結論として，日本では雌豚への安楽死はあまり行われていなかった。安楽死雌豚の淘汰パターンは死亡雌豚と同様であった。動物福祉の観点から，歩行困難等を示す雌豚は，死亡を待つのでなく，安楽死させることが望ましい。

キーワード：死亡，安楽死，生存，動物福祉

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