

REPRODUCTIVE PERFORMANCE OF INDIGENOUS PIG BREEDS IN SOUTHEAST ASIA - A REVIEW

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SUMMARY

Many factors affect the reproductive performance of pigs; one of those factors might be from their genotype, parity contribution, disease, and nutritional problems, environment, and management practice. There have been several factors mentioned in the scientific literature on reproductive performance in commercial pig farms (modern breeds), but very few were indicated on native pig breeds, especially in some countries of Southeast Asia (SEA). However, native or indigenous pigs are still considered as the main domestic animal species in rural areas of the SEA region. The present review aimed to explore the main constraints or barriers to the reproductive and productive performance of native pig breeds in some countries in the SEA region. Moreover, the review aimed at exploring options that could be adopted to improve the productive and reproductive performance of the native pigs in the region. The review found many factors influencing the reproductive performance of the native pigs in some countries in the region, among which include; genotype of native pigs, poor feed supply in both quantity and quality, parasite and disease problem, and poor management practices. One of the most significant factors might be the management practice of farmers. However, it was observed that farmers in Vietnam perform quite well, where numerous of them provide better feed to the native pigs with commercial feeds. They also improved their prolificacy of certain local pig breeds like Mong Cai and Ban pig breeds by crossbreeding them with exotic breeds such as Large White, Yorkshire, among others. In this case, the crossbreeding might not be suitable/favourable for gene preservation; in consequence, most of the best pure native pig breeds in Vietnam almost disappeared. Lastly, the management practices should be taken into consideration on improving the reproductive performance of indigenous pigs in some countries of Southeast Asia, particularly in countries like Laos, Vietnam, Philippines, Cambodia, and Timor East.

ÖSSZEFOGLALÁS

Xayalath, S. – Rátky, J. – Komlósi, I.: DÉLKELET-ÁZSIAI ÓSHONOS SERTÉSFAJTÁK SZAPORASÁGI TELJESÍTMÉNYE – IRODALMI ÁTTEKINTÉS

Sok tényező befolyásolhatja a sertés szaporasági teljesítményét, így pl. a genetikai háttér, a keresztezés, az állategészségügyi és takarmányozási problémák, a környezeti és menedzsment hatások. Sokat tárgyalt a tudományos szakirodalom a kereskedelmi vagy modern fajták esetében, de nagyon kevés elemzés született az őshonos fajtákról, különösen néhány délkelet-ázsiai ország sertéseiről, pedig a régió vidéki térségeiben ezeket tekinthetjük az elsődleges háziállatoknak. A jelen közlemény rövid áttekintést kíván adni néhány délkelet-ázsiai ország őshonos sertésfajtaiban a termelési és szaporasági mutatók korlátairól. Továbbá fejlesztési irányokat is megjelöl, amelyek révén a fenti mutatókat javítani lehet. Számos tényező befolyásolja a régió országaiban az őshonos sertések szaporasági teljesítményét: a genotípus, a mennyiségben és minőségben gyenge takarmányellátás, az élősködők okozta és egyéb megbetegedések, és az alacsony színvonalú menedzsment. Talán az egyik legfontosabb az utóbbi, a termelők napi gyakorlata. Például Vietnámban a gazdák egy része viszonylag hatékonyan termel, mivel magasabb értékű kereskedelmi tápot etetnek és a helyi fajtákban javították a reprodukciós paramétereket. Egyebek mellett nagyfehér és Yorkshire fajtával keresztezték őshonos Mong Cai és Ban fajtáikat. Ugyanakkor a keresztezés nem szolgálta a génmegőrzést, ezáltal majdnem kihalt néhány kiváló őshonos vietnami fajta. Következésképpen a menedzsment fejlesztését és a genetikai érték megőrzését is figyelembe kell venni a szaporasági mutatók fejlesztése érdekében pl. Laoszban, Vietnámban, a Fülöp-szigeteken, Kambodzsában és Kelet-Timorban.

INTRODUCTION

Southeast Asia (SEA) has considered as a diversity area of domestic animal breeding primarily indigenous pig breeds smallholders raise most of them, and always in the rural areas (*Deka et al.*, 2014) and 15 different phenotype and genotypes of indigenous pig breeds are in Vietnam (*Van Ba et al.*, 2019). *Huynh et al.* (2007) reported that smallholders performed around 80 percent of pig production in Vietnam, Laos, the Philippines, and Cambodia. In a similar report of *Herold et al.* (2010), more than 80% of national pig herd in Vietnam was kept by smallholder pig farms, and more than 90% of the pig population in Laos in 2018 was native pigs (*Keonouchanh*, 2018). Therefore, indigenous pigs are considered as a valuable component in the rural animal farming system (*Shrestha et al.*, 2014). Although, most of the indigenous pigs are considered as having lower productivity performance compared to modern pig breeds, but most of the indigenous pigs are considered as hardy, resistant to various diseases, and can adapt to harsh rural conditions with low inputs of the productive process (*Nidup et al.*, 2010). Native pig production systems in Southeast Asia are generally linked to rural farmers and always depended on rice production and the use of locally available feed with low investment and, consequently, as the low nutrient content (*Thanh Hai*, 2002; *Noronha et al.*, 2017).

There are many problems of reproductive performance in indigenous pig breeds, i.e., higher fat to muscle ratio, late puberty, seasonal breeding, low parturition rate per year, low growth rate, low weight at birth and weaning, high mortality of piglets in comparison with exotic breeds (*Phengsavanh et al.*, 2010; *Naronha et al.*, 2017). Some of the factors that can affect the reproductive performance of pigs include genetic makeup and health status, diseases, nutrition, and general environment provided for the breeding females, among others (*Varley*, 1989). This is similar to the report of *Kunavongkrit and Heard* (2000), indicating that four major factors are affecting reproductive performance in swine breeding herd in SEA they include; climate, diseases, nutrition, and management practice of farmers. However, there is still the need to improve the productivity of local pig breeds used in organic smallholder livestock production systems, to promote and educate farmers on genetic improvement and health services to help them develop their pig production systems (*Bondoc*, 2015).

The present review covered the main areas, such as; identifying the potentials of native pigs in SEA and factors influencing their reproductive performance. It also explored the approximated management strategies that could be used to improve piglet survival rate, number of weaned piglets per sow per year, and to reduce the mortality of the pre-weaning piglets of native pigs in the region.

BREEDS AND CHARACTERISTICS OF INDIGENOUS PIG BREEDS IN SOUTHEAST ASIA

Almost all native pigs are characterized by their black colour which is not uncommon with white, red, or black spots. Both sow and boar have an average weight between 40 and 60 kg (*Santiago*, 2018). The different physiology and phenotype of native pig breeds from different countries, reproductive efficiency, and

reproductive performance of native pigs in SEA countries are indicated in *Tables 1-4*. The tables also show that even among scientists and local experts, there is no consistent approach to describing the reproductive physiology of native pig breeds in SEA countries. Most of the breeds are commonly late at the age of first farrowing, and small litter size, except Mong Cai "Vietnamese" (*Dang-Nguyen et al.*, 2010). They always play an important role in the agricultural sector because of their ability to live within the range of local weather conditions; for this reason, their preservation becomes necessary (*Thutwa et al.*, 2019). Indigenous pig breeds are the key to sustainable pig farming in the various environmental conditions, because of their ability higher adaption to the harsh changing environment and well-fed local feeds (*Towers*, 2016) and it is considered as low input for production and cost of management (*Wilson*, 2007). Native pigs are not only resistant to many diseases and adaption to harsh rural conditions with low input, but they are also considered to play an important role in livestock biodiversity, which is considered as critically important for achieving food supply security and alleviating poverty for the rapidly growing human population in third world countries (*Nidup et al.*, 2010; *Bondoc et al.*, 2017). Although there are many constraints associated with the production of indigenous pig breeds such as high fat percentage, low productivity, and reproductive performance, small litter size, small body size, and

Table 1.

The different reproductive traits of native pigs in some countries of Southeast Asia

Names of indigenous pigs based on regions (1)	Farrowing interval, day (2)	Weight of maturity sow, kg (3)	Frequency of litter/year (4)	Age at first litter, day (5)	Litter size (6)	Age at first estrus, day (7)	Region/country (8)
Moo Chid ^{1*}	NA	42-48	1.5	360	7-8	182-197	Laos (9)
Moo Lat Pig ^{1*}	NA	47-61	1.5-1.8	360	7-8	189-586	
Moo Mhong ^{1*}	NA	65-85	1.5-1.8	300-330	7-10	150-180	
Moo Daeng ^{1*}	NA	65-90	1.5-1.8	330-360	7-10	NA	
Black Tiaong ^{2*}	239±108	NA	1.99	591±322	5.7±2.3	NA	Philippines (10)
Kalinga ^{2*}	208.1±1.6	NA	2.58	485±156	5.3±2.3	NA	
Mong Cai ^{3*}	NA	60-80	1.8-2.0	150-180	11-14	180-240	Vietnam (11)
Soc ^{3*}	NA	50-55	1.1-1.2	300-330	6-10	180-270	
Mong Khuong ^{3*}	NA	92	1.2-1.3	270-300	5	180-210	
Meo pig ^{3*}	NA	114	1.2-1.4	270-300	6-7	240-270	
Co pig ^{3*}	NA	Na	1.2-1.3	270-300	6-7	60-90	
I pig ^{3*}	NA	50-65	1.6-1.7	180-240	8.8-11.3	120-150	

^{1*}Keonouchanh et al. (2011); ^{2*}Nidup et al. (2010); ^{3*}Dang-Nguyen et al. (2010); NA= not available

1. táblázat Különböző szaporasági mutatók néhány délkelet-ázsiai őshonos sertésfajtában

az őshonos sertésfajták neve (1); fialások közti idő, nap (2); kocák súlya a tenyészettség elérésekor (3); fialás/koca/év (4); életkor első fialáskor, nap (5); alomnagyság (6); első ivarzás, nap (7); régió/ország (8); Laosz (9); Fülöp-szigetek (10); Vietnám (11)

mature weight compare to modern and crossbred animals (FAO, 2009). But in the least developing and developing countries, most indigenous pig breeds are still dominant animals raised by small scale farmers in rural communities as their local market income and household consumption (Silva *et al.*, 2016).

Important to note that Mong Cai is considered as getting in breeding age relatively early (average 165 days at the age of first farrowing), and a breed with the

Table 2.

Reproductive efficiency of Vietnamese indigenous pig breeds

Parameter (1)	Name of Vietnamese indigenous pig breeds (2)					
	I	Mong Cai	Mong Khuong	Soc	Meo	Co
Oestrus cycle (day) (3)	19-21	21	20-21	20-21	21-22	21-22
Length of oestrus (day) (4)	3-4	3-4	5-6	4-5	5-6	5-6
Age of first oestrus (month) (5)	4-5	6-8	6-7	6-9	8-9	2-3
Number of parturition per year (6)	1.6-1.7	1.5-2.0	1.2-1.3	1.1-1.2	1.2-1.4	1.2-1.3
Litter size (7)	8.8-11.3	10-14	5	6-10	6-7	6-7
Weight at weaned pig (kg) (8)	3-4	6-7	5-6	5-6	4-5	3
Parturition interval (month) (9)	6-7	5-6	9-10	10-11	9-10	9-10

Source: Dang-Nguyen *et al.* (2010)

2. táblázat Vietnámi őshonos sertésfajták szaporasági mutatói

mutató (1); a fajták neve (2); ciklus hossza (nap) (3); ivarzás időtartama (nap) (4); életkor első ivarzásakor (hónap) (5); fialás/koca/év (6); alomnagyság (7); választási tömeg (kg) (8); két fialás közti idő (hónap) (9)

Table 3.

Pig reproductive performance in smallholder and large pig farms in Laos

Parameter (1)	Smallholder (2)	Large scale (3)
Age of sows at 1 st service (month) (4)	8.8-10.5	7.8
Weight at 1 st service (kg) (5)	28-43.6	96.6
Litter per year (6)	1.4-1.8	2
Piglet per litter (7)	7-7.6	10.5
Piglet at the time of weaning (8)	4.3-6.2	9.5
Mortality (%) (9)	17-36.9	9.5
Piglet age at weaning (month) (10)	2.7-3.6	1.3
Piglet weight at weaning (kg) (11)	7.3-7.5	11.5
Turnover time for sows (year) (12)	4.8-5.4	3.8

Source: Phengvilaysouk *et al.* (2017)

3. táblázat Reprodukciós mutatók laoszi kistermelőknél és nagyobb üzemekben

mutató (1); kistermelő (2); nagyüzem (3); első termékenyítés ideje (hónap) (4); testtömeg első termékenyítéskor (kg) (5); fialás/koca/év (6); alomnagyság (7); választott malac/alom (8); elhullás (%) (9); választási életkor (hónap) (10); választáskori testtömeg (kg) (11); kocák selejtezési életkora (év) (12)

Table 4.

Reproductive performance of native pigs raised in Timor East

Parameter (1)	Min.	Max.	Mean	Std.dev.
Age at puberty, male (months) (2)	4	6	5.55	0.55
Age at puberty, female (months) (3)	5	6	5.95	0.22
Age at first mating (months) (4)	5	14	9.15	1.73
Age at first parturition (months) (5)	9	18	13.24	1.65
Length of estrus cycle (days) (6)	18	22	20.83	1.07
Gestation period (months) (7)	3.5	4	3.94	0.17
Interval between parturitions (months) (8)	6	12	7.75	1.21
Litter size at birth (9)	2	12	6.34	1.82
Litter size at weaning (10)	1	10	5.28	1.82

Source: *Noronha et al.* (2017)

4. táblázat Kelet-timori őshonos sertésfajták szaporasági mutatói

mutató (1); ivarézés ideje, kanok (hónap) (2); ivarézés ideje, koca-süldők (hónap) (3); első párózta-tás ideje (hónap) (4); első fialás ideje (hónap) (5); ivarzási ciklus hossza (nap) (6); vemhességi idő (hónap) (7); két fialás közti idő (hónap) (8); születéskori alomszám (9); alomszám választáskor (10)

largest litter size (average 12.5 piglets/litter) among native pigs in SEA. Therefore, Mong Cai is always used as a maternal line for crossbreeding with other local and exotic breeds in Vietnam to increase the number of litter size and pork production (*Huyen et al.*, 2005). Another interesting point is that Kalinga, the native pig breeds of the Philippines, has the highest of the farrowing index at 2.58. Still, unfortunately, it seems to have the smallest number of litter size. However, there is no scientific evidence explaining the reasons.

FACTORS INFLUENCING REPRODUCTIVE PERFORMANCE OF INDIGENOUS PIG IN SOUTHEAST ASIA

Smallholders keep most of the indigenous pig breeds in SEA, and they are raised based on free-range, semi-intensive, and penned systems with a lack of systematic management. These pig raising systems are considered as the input, and the consequent is also low (*Lemke et al.*, 2006; *Valle Zarate and Markemann*, 2010; *Phengsavanh et al.*, 2011; *Bondoc et al.*, 2017; *Noronha et al.*, 2017). Many factors affect reproductive performance in commercial pig productions. Still, there are few reports on factors that are directly associated with the reproductive performance of indigenous pig breeds in SEA countries. The common constraining factors also cover the areas of nutrition, disease outbreak, management practice, climate, and genetic factors. This has created the consequence of low piglet performance, high mortality piglets both pre- and post-weaning periods (*Lanada et al.*, 1999; *Kunavongkrit and Heard*, 2000; *Herold et al.*, 2010; *Phengsavanh et al.*, 2010). The key to these challenging factors presumably comes from weak or still not appropriated management practices, particularly in the remote areas of the

Northern Laos (*Xayalath and Sacklorkham, 2010*). The general term of factors that could influence sow to produce a small and large number of piglets was listed above (*Aherne and Kirkwood, 2001*), and the factors affecting reproductive performance in indigenous pig breeds in Southeast Asia could be influenced by one of them.

Nutrition factors

Nutrition is a core issue of growth and reproduction in pigs. The feed intake is always measured as the fundamental component for physiology parameters and the reproductive performance of gestating gilts. The high energy diets have an influence on body weight and back-fat thickness of sows during gestation and lactation. Moreover, the approximate metabolisable energy level (26.78 MJ) per day positively influenced the high weaning number of piglets per sow (*Jin et al., 2016*). The variations in nutrition around weaning to re-mating period and the post-weaning oestrous period affected the ovulation rate, and the post-weaning nutrition affected to return to oestrus and on conception rate (*Brook and Cole, 1974*).

Based on the better adaptation ability of indigenous pig breeds to environmental condition, most of the native pig breeds in Southeast Asia, are still raised by smallholders or householders in rural areas particularly in the mountainous areas, and they always feed their pigs with rice bran, cassava root, other available vegetable scraps and kitchen residues with low nutrient content (*Huynh et al., 2007; Chittavong et al., 2012; Kaensombath, 2012*). The result of low input and inadequate nutrition led to gain a low growth rate and high mortality rate of piglets. Particularly in Laos, the average daily gain (ADG) of native pig breed is only between 80 and 100 g (*Keonouchanh and Dengkhounxay, 2017*), and the mortality rate in piglets is 50% (*Phengsavanh et al., 2010*). Cambodia, Laos and Timor East have not different in terms of pig feed and feed intake; most of the farmer raised their pigs based on rice by-products and also feed the pigs with certain feeds like; broken rice, rice bran, cassava, sweet potato, and other vegetable scraps when available. With the consequence of the inadequate feed intake and as well as the low nutritive value of feeds, the growth rate was diminished (*Huynh et al., 2007; Chittavong et al., 2012; Australian Aid, 2017*). In the north of Laos, more than 70% of piglet mortality is caused by sows not having enough milk, particularly during August and September, when farmers had a shortage of rice (*Xayalath and Sacklorkham, 2010*). Several reports, e.g., *Phegvilaysouk et al. (2017, 2018)* showed the improvement of the piglet survival and better growth rate and improved reproductive fitness of sows by providing adequate amount of nutrients and water *ad libitum* during lactation. Anyway, no evidence or research is proving that farmers gave concentrated feed to local pigs in the mentioned three countries. However, in Vietnam, more than 50% of indigenous pig raising system is confined, farmers provided complete commercial feed to mix with kitchen waste and other grain to the feed (*Silva et al., 2016*), but did not consider its effects on the reproductive performance. In the Philippines, farmers always provided farm products and by-products, and occasionally commercial and self-mixed feed for their indigenous pigs (*Villanueva and Sulabo, 2018*). In summary, there are only rare information about the nutrition factors influencing the reproductive performance of the indigenous pig breeds in SEA countries.

Environmental and genetic factors

Many studies on environmental factors affecting the reproductive performance of pigs, but most of them were dealing with commercial farms or modern breeds; however, there are only a few reported studies on indigenous pig breeds, particularly in the Southeast Asia region. It has been well known that the environmental conditions, such as light and temperature, are the two major environmental factors that may play a role in the litter size of sows. While high ambient temperature ($> 30^{\circ}\text{C}$) at mating is usually associated with small litter size, high environmental temperature occurring two or three weeks after mating is extremely detrimental to profligacy (Varley, 1989; Janse van Rensburg and Spencer, 2014). Kabare (1991) reported that piglets born during the cold season would have low pre-weaning growth performance and subsequently have smaller bodyweight at weaning than others born during the rest of the year. Obviously, alongside environmental factors, genetics is also the prominent crucial factor of the reproductive performance in pigs; nevertheless, exploitation of genetic value could be supported by the improvement of other mentioned factors. Anyway, genetic selection for sow productivity has resulted in larger litters and heavier weaning weights (Yoder, 2013).

The indigenous pig breeds adapted into various environment conditions could produce under the harsh environment and are resistant to different diseases (Bondoc *et al.*, 2017), and could be fed with low-quality feed (Herold *et al.*, 2010). This advantage of indigenous pig breeds might be the criteria necessary to adapt to local environmental factors without much harm to sow and piglet performance. In Vietnam, the indigenous pigs are farmed as the main income in the rural community. At many units, pigs are kept mainly under the confined system and bred mostly by controlled natural breeding, occasionally artificial insemination serviced by nearby boar stations (Silva *et al.*, 2016). In the north of Vietnam, farmers try to improve the genetic value of local pig breeds to increase the average litter size, faster weight gain alongside the market demand where the area is close to cities. For example, Mong Cai sows are usually mated with Large White or Yorkshire boars to improve the lean meat yield and carcass quality (Herold *et al.*, 2010; Valle Zarate and Markemann, 2010). There is a similar action, from 2016 to 2018 a research program was carried out in Laos to improve the genetics of small body and litter size, and diminished growth rate of Lao native pig breeds by crossbreeding between local sows and Duroc boars. The results demonstrated twice a bigger new-born and weaned weight, and the litter size was also significantly higher (Keonouchanh, 2018).

Management practice of farmers

Management is a crucial issue to indicate the success and efficiency of pig reproductive performance. It should cover all areas of pig reproductive systems, i.e., caring sow before and after farrowing, caring piglets both during lactation and after weaning. The effect of improved lactation nutrition on piglet weaning weight and gilt rebreeding is more obvious, but improvements in housing conditions can achieve similar benefits. Under certain circumstances, housing improvement may be a more cost-effective way of improving sow performance than expenditure on

additional feed resources (*Edwards et al.*, 2003). On the other hand, the animals can temporally suspend their reproductive activity if they live in an unfavourable or trouble conditions (e.g., becomes lame, experiences of social problems or environment stress). A variety of mechanisms is activated to suppress reproductive efficiency and maternal abilities as hypothalamic, pituitary, and ovarian axis function is compromised under stress situations (*Borell et al.*, 2007).

Most indigenous pig producers in Southeast Asia use traditional methods with low input, poor or not appropriate management practice for both sow and piglet performance, especially in the farrowing period with low output consequence on the number of surviving piglets at the time of weaning or high mortality before weaning time. Women and children are the main labour force of raising and caring for native pig production in rural areas (*Valle Zarate and Markenmann*, 2010; *Chittavong et al.*, 2012; *Phengvilaysouk et al.*, 2017). However, the aspects of health, breeding, and piglet management are the main factors in the reproductive performance of smallholder sow in the Philippines (*Lanada et al.*, 1999).

Vietnam is a good example in the region that has sufficient documentation to show how farmers improved breeding performance in their native pig breeds through crossbreeding with commercial breeds, as found clearly explained the distinguish of gilts selection and breeding (*Lemke et al.*, 2006). It indicated that farmers near to cities purchasing gilts at markets, and occasionally applying artificial insemination for their sows with the cooperation with nearby government boar stations. Farmers who lived far away from cities would select their gilts from their herds and other villages' herds, and they always borrowed the boar from boar owner or used their boar progeny as natural mating.

In the case of native pig breeds in Laos, there is an urgent need for improvement in litter size per year, especially the numbers of survival piglets at the time of weaning. This might be supported by providing better nutrition to the sows and piglets, particularly during the period of lactation (*Phengvilaysouk et al.*, 2017). The reproductive management methods still have not been improved, e.g., sow management both before and after pregnancy, weaning, housing, etc. One option should be improved piglet survival and better growth rate and improved reproductive performance of sows by providing water ad libitum during farrowing and providing nesting materials 1-2 days before the expected farrowing day (*Phengvilaysouk et al.*, 2018). Nevertheless, the breeders' knowledge improvement is also the main consideration to upgrade the quality of pig productive and reproductive performance for the small scale pig farms in Laos.

According to *Noronha et al.* (2017) the limited knowledge of basic management of indigenous pigs producers in Timor-East, as recorded data (e.g., date of birth, age of first farrowing, weight at birth, average daily gain, etc.), feed and feeding, housing, health care, disease prevention, and marketing. This basic knowledge should be taken into account of consideration for better productivity of native pigs.

Diseases and health factors

Diseases (Classical Swine Fever, diarrhoea in piglets, African Swine Fever, and metabolic diseases) are always considered as crucial problems that can influence reproductive performance in pigs. Mainly the native pigs are raised by farmers with

traditional methods in rural areas without consideration of animal health control. In the SEA region, the climate is characterized by constantly high temperatures ($>25^{\circ}\text{C}$ round year) and high humidity (Huynh *et al.*, 2007), unfortunately, suitable for both bacterial and parasite survival. Moreover, disease control and health care management for pig production systems commonly occurred only at commercial farms. Infectious diseases directly harmed reproductive efficiency and caused stillborn mummified embryonic death, and infertility (Kunavongkrit and Heard, 2000). Most of the reviewed countries (Laos, Vietnam, Cambodia, Philippines, and Timor East) suffered from epidemic outbreaks as key factors affecting pig performance with the result of high mortality in both pre-and post-weaning piglets. Many research showed that in Laos the mortality of piglets is between 30 to 50 percent (Phengsavanh *et al.*, 2010; Chittavong *et al.*, 2012). More than 42 % of piglets died in the rural areas of the southern part of Laos due to infectious diseases (Xayalath *et al.*, 2016).

CONCLUSION

The reproductive performance of the sow, which includes the number of piglets weaned per sow per year and pre-weaning piglets' mortality, needs to be improved for smallholder pig producers in SEA. It is a key point of developed food supply and poverty alleviation. And there are several pieces of researches describing the constraints of improving the reproductive performance in native pig breeds in the region, such as nutrition of the sows and piglets, genetics improvement, disease control, and management practices of farmers. These factors, particularly the management practice of farmers, should be considered to improve the better reproductive performance of native pigs. Based on the present review, native pig breeds with special regard to SEA counties are rarely mentioned in scientific works of literature. Therefore, there is a need for more studies to get knowledge of the real situation based on different environmental and social conditions in these areas.

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