Full length article

Performance of Exotic Breeds of White Pig under Bhutanese Farmers' Management Conditions

GYEMBO TSHETEN* | TENZIN PENJOR | PEMA SHERAB

National Piggery Research Centre, Department of Livestock, MoAF, Gelephu, Sarpang, Bhutan
**Author for correspondence*: email- gyembotsheten@yahoo.com

ARTICLE HISTORY

Received: 25/11/18
Peer reviewed: 22/12/18
Received in revised form: 30/12/18
Accepted: 01/01/19

KEYWORDS

Diseases
Feedstuffs
Growth performance
Management
White pigs

ABSTRACT

We assessed the growth performances and disease susceptibility of exotic white pigs under farmers' management conditions in Bhutan. Twelve low homogenous weanlings of Large White and Landrace were randomly selected. The mean age of weanlings was about 53 days with mean body weight of about 11 kg. The white pigs were housed in available sheds and managed under normal routine feeding followed by farmers, and weighed 14 days apart for 17 times. The growth rates of exotic white pigs Large White and Landrace, and male and female were 0.35 kg and 0.41 kg, 0.34 kg and 0.44 kg, and 0.34 kg and 0.41 kg, respectively. The majority [67%] of pigs showed clinical signs of diseases such as tiny redness on their white skin, diarrhea, cough and anorexia. Of that, 75% occasionally indicated skin problem with tiny redness on their white skin. The growth rate of exotic white pigs that did not suffer from any disease was significantly greater than the pigs that suffered from diseases. To optimize the growth rates of exotic white pigs, the overall management conditions of Bhutanese farmers must be improved. An intensive care and higher inputs such as feed, housing and health services may help to realize greater genetic potentials of exotic white pigs.

1. INTRODUCTION

Livestock production contributes substantially to the global food security [Falvey 2015]. Animal production is important not only for supplying quality food for growing population, but also for their significant contributions to the country's economy [Nga et al. 2014]. Among livestock, pig population represents only about one percent of the total livestock population and about 25% of the total domestic meat production in Bhutan [DoL 2016]. Pork is the most consumed meat in the world [FAO 2012]. The demand for pork in Bhutan is reasonably high and the deficit is met through import from India. In 2016 alone, the domestic pork production was only 740 MT and approximately 1877 metric tons [MT] of pork was imported [DoL 2016]. As there is worldwide increase in demand for meat, it is important to focus on livestock species with faster growth rate.

Exotic pig breeds are highly productive [Huyen et al. 2005]. About 60-70% of their performance potentials are realized when raised in other countries [Thien et al. 1996]. In 2016, the Royal Government of Bhutan imported exotic white pig breeds [Large White and Landrace] from Thailand to replace the existing color breeds in the country. The exotic white breeds are hardy, known to withstand a wide range of climatic conditions. They are commonly used in crossbreeding or hybrid programs, with the most popular cross being Large White and Landrace. This cross is often used as the maternal line in commercial herds. These breeds of pigs were identified to be suitable for the farming conditions of Bhutan. However, as the pigs are reared under difficult conditions in Bhutan and with minimal investment, it is yet to understand the performance of exotic white pigs under conditions and production practices of Bhutan. Therefore, this study was undertaken with the objectives to assess the growth performances and disease susceptibility of exotic white pigs under Bhutanese farmers' management conditions. The study is also expected to contribute to developing general management guidelines for white pig breed in Bhutan.

2. MATERIALS AND METHOD

2.1 Study location and selection of village and farmers

The study was conducted from October 2017 to June 2018 in four *Gewogs* of Tsirang and Sarpang districts [Figure 1]. The study areas were selected purposively based on the popularity of pig farming. The study identified three interested pig farmers from each district who were interested to rear exotic white pig breeds.

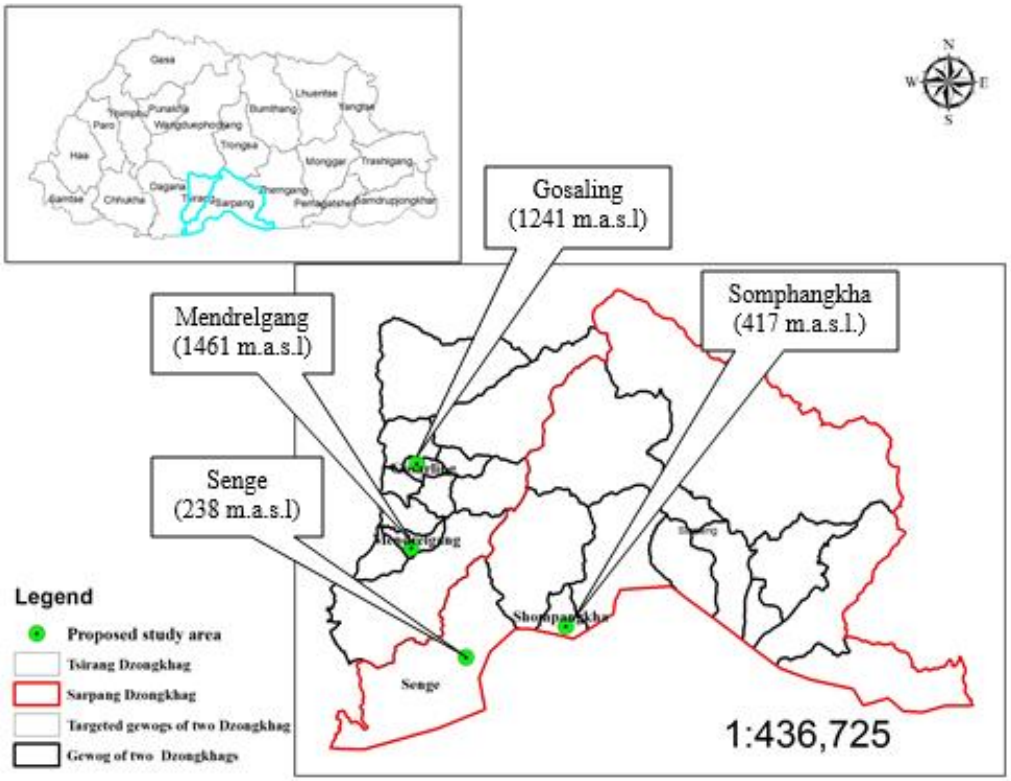

Figure 1: Location of research areas.

2.2 Animal selection and distribution

A total of 12 low homogenous weanlings of exotic white pig breeds with uniform body size and age were selected from the Regional Pig Breeding Centre [RPBC] at Yusipang. The mean age of weanlings was about 53 days with mean body weight of about 11 kg. The weanlings were randomly selected and comprised of equal breed and sex ratios. They were transported to research sites for distribution. Every identified farmer was given two weanlings of same breed with equal sex ratio for rearing.

2.3 Animal housing and feeding management

The exotic white pigs were housed in available sheds and managed under normal routine feeding practices followed by farmers. No special housing, feeding and health management were provided. Pigs received varying diets, ranging from commercial feeds to locally available feedstuffs, including wild plants that are suitable for use as feed for pigs. Pigs were fed twice a day, in the morning and evening. Water was provided during feeding with additional water during day time when necessary, but not *ad libitum* as followed by Mullaert [2010].

2.4 Body weight measurement and disease inspection

Pigs were weighed at the time of selection. Thereafter, they were weighed every two weeks interval for 17 times during the entire study period. A digital weighing balance [CAMRY® – *Electronic Scale, Model: EL10/EL11]* was used to weigh pigs until 30 kg body weight. After that, a 200 kg capacity machine [*Virgo™ — light and portable suspension scale]* with an accuracy of 1.0 kg was used. The weighing balances were reset before each new measurement. The length girth formula was not used because misreading the girth measurement by one centimetre would result in an error of 4-5kg in weight at 95% confidence interval [Groesbeck 2004].

An ocular health inspection of study animals was conducted during each weight measurement. Clinical signs of diseases and treatment regimens were recorded to measure disease susceptibility of the exotic white pigs.

2.5 Data collection, recording and analysis

A well-designed data sheet was used to record body weight gain, clinical cases and feed resources used. Additional information was gathered through informal questionnaire survey at the end of the trial to complement the study. The birth weight and weight gain from birth till 52 days were retrieved from farm recordings at RPBC Yusipang. All data were compiled in Microsoft Excel program.

The software Statistical Package for Social Sciences [SPSS] version 23.0 was used to analyse the data. Independent samples t-test was conducted to compare mean body weight gain between breed, sex and districts. Descriptive statistics was used to determine mean and standard deviation of age, body weights and growth rates. Microsoft Excel program was used to generate graphs and tables.

2.6 Ethical issues

The study was approved by the Livestock Research Committee of Bhutan. A prior written approval was granted for the use of proposed animals for this study. The animals were transported to the study areas carefully and safely with minimal injuries. For the entire study period, the research animals were handled safely and carefully, especially during body weight measurements.

3. RESULTS AND DISCUSSION

3.1 Feed and feeding practices

Feed resources used for the pigs were almost uniform across all study sites. As per daily feed records, all pigs received only commercial feeds for the first few days and gradually shifted to other local feedstuffs. The broad feedstuffs were kitchen wastes, vegetable wastes, wild plants, brewery waste, agricultural crop residues and commercial feed [concentrates] [Figure 2]. These local feed resources are less expensive and often available free of costs. According to Ten Napel [2014], locally available feedstuffs are fed to pigs, especially in Asia, to minimize production cost. Nasker et al. [2003] and Kumaresan et al. [2007] also observed pig farmers feeding available local feeds to pigs under village conditions. However, the repeated use of local feedstuffs as pig feed might lead to nutritional imbalance and underfeeding due to limitations in the quality of local feedstuffs [Phangsavanh et al. 2014].

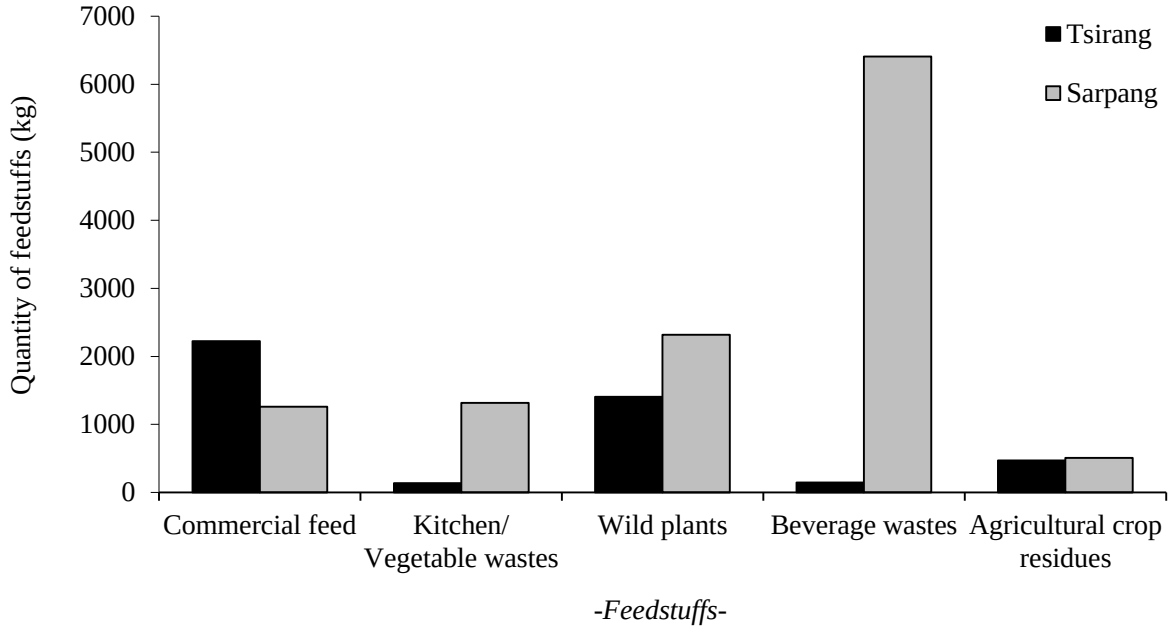

Figure 2: Types of feedstuffs used for feeding exotic white pigs at the study sites.

3.2 Pig and housing management

Pig housing and hygiene management varied across farms. About 30% of research pig farmers raised exotic pigs in traditional type sheds constructed from wooden planks. According to Kharka Bahadur Tamang [63] of Mendrelgang and Nima Dolma Tamang [33] of Gosarling, white pigs were kept in wooden sheds with a purpose to protect them from cold weather. The remaining 70% pig farmers had raised pigs in concreted sheds. The majority [83%] of white pig raisers mentioned that white pigs are doing well in concrete sheds. The exotic white pigs were mentioned to show faster growth rates compared to the existing colored breeds such as Saddle Back, Large Black and Duroc Jersey. Only one respondent found cold climatic conditions to affect the performance of exotic white pigs. On the future improvement options, about 80% of respondents felt that the performance of exotic white pigs could improve if commercial diet and *ad libitum* water are provided. They also felt it important to maintain a good shed sanitation and hygiene for the white pig breeds.

3.3 Growth performance of exotic white pigs

The results on weight gains of exotic white pigs are presented in Table 1. The Average Daily Gain [ADG] from birth to 52nd day was lower than ADG during the study period. ADG of pigs reported by Eliasson [2012], Kelly et al. [2007], Rodriguez-Estevez et al. [2011] and Stupka [2004] varied widely according to breed, gender, season, growth period, type of feeds fed, feeding practice, herd size, and level of pig production. The ADG of 0.76±0.01 kg was reported by Rodriguez-Estevez et al. [2011] in pigs feeding only on local feed resources. The ADG in this study was 0.38±0.11 kg [from 52 to 288 day], which is comparatively lower. However, ADG of 0.11±0.047 kg for local crossbred pigs in rural areas was reported by Carter et al. [2013]. According to Thorne [2005], pigs raised in smallholder farms do not get appropriate feed, and lack protein in diet that limits growth. The birth weight also positively affects future growth

performance with improved growth rates in heavy-born piglets [Heyer et al. 2004]. Furthermore, inadequate facilities to control ambient temperatures of farms negatively affect growth [Quiniou et al. 2000].

The mean body weight of piglets decreased by 0.12 kg at 14 days from the first day of the study. Stressful events such as human handling, transportation, co-mingling with pigs from other litters, different food source and new physical environment are reported to affect intestinal and immune system lead to reduced growth [Campbell et al. 2013] and undesirable consequences in normal pigs [Martinez-Miro et al. 2016]. Therefore, the weight decrease may be attributed to stressful events during the outset of the study. An appropriate health, nutrition and management strategies are important to minimize adverse effects of such stressful events [Campell et al. 2013]. Moreover, intensive care and higher inputs such as feed, housing and health services are required to achieve their genetic potentials [Quac et al. 1996]. Pigs managed under poor inputs are reported to have low performance [Carter et al. 2013] as they cannot express their full genetic potential for growth [Tatwangire 2013]. Thus, improved nutrition and management at village levels would increase the growth performance of exotic white pigs.

Table 1: Overall average [±SD] body weight gain of exotic white pigs under Bhutanese farmers' management conditions.

Parameter	Body weight [kg]
Initial mean body weight at 52 days at selection and distribution	10.98±1.25
Mean body weight at 14th day from onset of the study [M1]	10.85±1.63
Final mean body weight	101.27±26.26
Mean weight gain during study period [236 days]	90.14±26.40
Average daily gain during study period [53-288 days]	0.38±0.11
Average daily gain from birth to 52 days of age	0.18±0.03

3.4 Growth Performance by study location

The ADG [0.41±0.13 kg] of pigs raised in Sarpang district was higher than pigs [0.35±0.90 kg] raised in Tsirang district [Figure 3]. The difference in growth performance may be due to varying climatic conditions, input levels and management practices of different farms. Environmental factors like season is reported to have a significant effect on the growth of pigs [Eliasson 2013]. However, in this study, there was no significant effect of season on body weight. Growth performance of pigs also depends on quality of management [Dedecker 2000] and rearing environment [Gentry et al. 2004]. Higher growth rate is achieved with appropriate management strategies [Rodrigues-Estevez 2011]. Therefore, the overall management on different pig farms must be improved to optimize the performance of exotic white pigs.

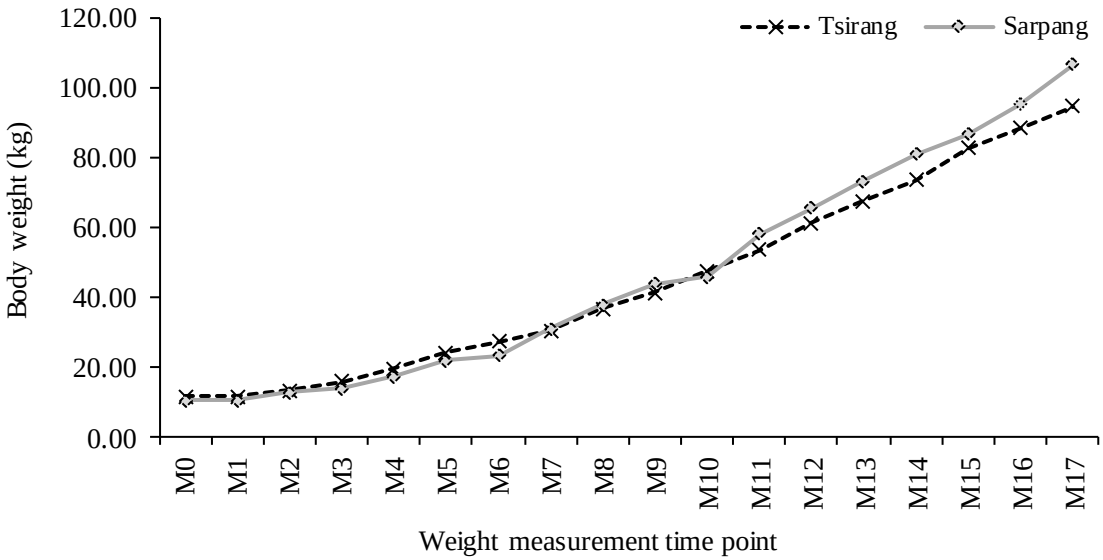

Figure 3: Growth trends of exotic white pigs under Sarpang and Tsirang districts. M stands for measurement and the interval between two measurements was 14 days.

3.5 Growth performance by breed

ADG was higher in Landrace [0.44±0.12 kg] than Large White [0.34±0.09 kg] pigs [Table 2]. Therefore, despite significantly higher initial mean body weight of Large White, the final body weight was higher in Landrace [113.80±27.90 kg] than the Large White [90.83±21.64 kg]. However, there was no significant difference in ADG and mean final weight between the breeds at 95% confidence interval. Influence of growth by breed and source of feed is reported by Kouamo et al. [2015]. The mean birth weight of Landrace [2.12±0.31 kg] was significantly higher than the Large White [1.50±0.06 kg]. This agrees with the findings of Eliasson [2013] and Heyer et al. [2004] who observed an influence on growth performance by birth.

3.6 Growth performance by sex

The final mean body weight in female pigs was higher than male pigs [Table 3]. The growth rate was higher by about 60 grams in female than male pigs. Contrastingly, in many previous studies, barrows were found growing faster than gilts, and the better growth in male pigs was attributed to greater feed intake [Stupka et al. 2004]. This contrasting result might be due to factors other than sex such as housing conditions and climatic factors as Souphannavong and Sringarm [2016] has reported the effect of these factors on growth performance of pigs. However, there was no significant difference in ADG and final weight gain between male and female white pigs at 95% confidence interval.

Table 2: Body weight gain of exotic white pigs by breed

Variables	Mean [± SD] body weight [kg] by breed	
	Large White	*Landrace*
Mean birth weight	1.50±06[a]	2.12±0.31[b]
Mean initial body weight	11.73±1.27[a]	10.23±0.70[b]
Mean final body weight	90.83±21.64[b]	113.80±27.90[b]
Actual mean body weight gain during study	79.11±21.10[c]	103.39±27.99[c]
Average daily weight gain	0.34±0.09[d]	0.44±0.12[d]

Values with different superscripts within rows are significantly different [p>0.05] at 95% confidence interval.

Table 3: Body weight gain of exotic white pigs by sex.

Variables	Mean [± SD] body weight [kg] by sex	
	Male	*Female*
Initial mean body weight	11.09±1.17[a]	10.86±1.44[a]
Final mean body weight	94.83±24.63[b]	109.00±28.78[b]
Actual mean body weight gain during study	83.74±24.46[c]	97.82±29.31[c]
Average daily weight gain	0.36±0.10[d]	0.42±0.12[d]

Values with different superscripts within rows are significantly different [p>0.05] at 95% confidence interval.

3.7 Susceptibility of exotic white pigs to skin and other diseases

The majority [67%] of exotic white pigs showed an evident sign of diseases such as diarrhea, cough, anorexia and pin-point redness on their skin [Table 4]. Of that, 75% indicated pin-point redness on white skin. According to McCosker [2014], tiny red pimples on the skin of pigs is one of the evidences of sarcoptic mange infestation. Most of the white pigs suffering from skin diseases are reported to have died in severe cases [Nidup et al. 2011]. However, the skin problem in this study was not severe. About 33% of pigs that suffered from pin-point redness on their skin were treated with subcutaneous injection of Ivermectin [HITEK™] @ 1ml/33kg body weight as recommended by DoL [2013]. The remaining exotic white pigs that suffered with skin problems improved with regular washing of the pigs using Lifebouy™ soap, and maintaining proper shed hygiene. Moreover, mange mite infection can be effectively treated with single injection of Doramectin [Jensen et al. 2002]. Diseases such as diarrhea, cough, and skin diseases particularly sarcoptic mange and lice infestation are reported as main diseases of pigs in Nigeria [Ironkwe and Amefule 2008]. These diseases are reported to affect pig performance [Carter et al. 2013], financial income [Chah et al. 2014] and on public health [Mahanty and Garcia 2010]. Therefore, a review of pig management and husbandry practices may be required to develop pig disease control measures. The clinical diseases in this study were probably attributed to inadequate shed hygiene, source of feed and cold climatic conditions. About 13% [n=1] of pigs died of sudden death. The pig initially suffered from cough. The remaining 33% of pigs did not show clinical signs of any diseases.

Table 4: The number and percentage of exotic white pigs suffered with various clinical diseases

Clinical cases	Number [n=12]	
	Count [n]	%
• *No evident sign of clinical disease*	4	33.3
• *Evident with signs of skin and clinical diseases*	8	66.7
Pin-point redness on skin	6	75
Diarrhea	4	50
Cough	2	25
Anorexia	2	25

ADG of pigs that showed evident signs of diseases [0.35±0.09 kg] was significantly [p<0.05] lower than the pigs that did not show any signs of disease [0.49±0.03 kg]. This indicates the possible effect of clinical diseases on the overall growth performance of exotic white pig. This result corroborates with the findings of Cargill and Dobson [1979] who observed lowered production in most white pigs suffering from skin diseases due to reduced growth and feed efficiency. The other factors such as climatic conditions, source of feed and type of sheds may also be responsible for the lowered ADG.

4. CONCLUSIONS AND RECOMMENDATIONS

This study concludes that the growth rates of the exotic white pigs are lower than the growth rates reported in many literatures. Nevertheless, the performance data in those literatures are rarely comparable as most of those studies were performed under commercial level with intensive care and feeding systems. Whereas the current study was conducted in the farmers' field as backyard level farming. Although, various reasons may account for the low growth performance of the exotic white pigs in this study, inadequate nutrition and shed sanitation are deemed to be the main reasons. Therefore, a good care and higher inputs such as feed, housing and health services would achieve greater genetic potentials of the exotic white pigs. The feeding of local feed resources aimed at reducing cost of production would appear less profitable for the exotic white pig farming. Besides, the health monitoring of exotic white pigs must be a part of routine investigation from the animal health service providers. Trainings to improve pig farmers' ability in pig management and awareness programs on economic losses from poor management and pig health related problems are deemed necessary to save pig farmers from economic losses.

Acknowledgements

The authors would like to thank all those who rendered their kind supports during the study. We are indebted to the *Dzongkhag* Livestock Sector, Tsirang and Sarpang for necessary supports. We are also indebted to the respective *Gewog* Livestock In-Charges in the study sites, for rendering their supports and being collaborative. We are also thankful to Dr. Nima, Veterinary Officer, Tsirang *Dzongkhag* for providing his technical guidance related to animal health services. Also, we are thankful to Mr. Pema Thinley, Livestock Production Officer, National Research Development Centre for Aquaculture [NRDCA], Gelephu, for his assistance in data analysis. Lastly, we thank Dr. Kesang Wangchuk, Principal Research Officer, Research and Extension Division, Department of Livestock, for his technical assistance in the study.

REFERENCES

Campbell JM, Crenshaw JD and Polo J [2013]. The biological stress of early weaned piglets. Journal of Animal Science and Biotechnology, 4:19.

Cargill CF and Dobson KJ [1979]. Experimental *Sarcoptes scabiei* infestation in pigs Effects on production. *Vet Rec.*, 104:33-36

Carter N, Dewey C, Mutua F, de Lange C, Grace D [2013]. Average daily gain of local pigs on rural and peri-urban smallholder farms in two districts of Western Kenya. Tropical Animal Health and Production, 45: 1533–8.

Chah JM, Dimelu MU and Ukwuani SU [2014]. Institutional and production characteristics among smallholder pig producers in Enugu State, Nigeria. Tropical animal health and production, 46: 1173–6.

Dedecker JM [2000]. Effects of space allowance in a wean-to-finish system and pig removal strategies at market on the growth performance and variation in performance of pigs. BSc. Dissertation. University of Illinois at Urbana-Champaign, Illinos.

DoL [2013]. National Veterinary Drug Formulary. 2nd edn. Minsitry of Agriculture and Forests. National Centre for Animal Health. Department of Livestock. Thimphu, Bhutan.

DoL [2016]. Livestock statistic 2016. Department of Livestock, Ministry of Agriculture and Forests. Thimphu.

Eliasson C [2013]. Variation in fattening pig exterior, gait and weight gain in commercial organic herds. [Master's Thesis]. Swedish University of Agricultural Sciences. Uppsala

Falvey JL [2015]. The food security: The contribution of livestock. University of Melborne Australia. Chiang Mai University. Journal of Natural Sciences.

FAO [2012]. Developments – timely updates. Food and Agriculture Organization of the United Nations, 1–6.

Gentry JG, McGlone JJ, Miller MF and Blanton Jr. JR [2004]. Environmental effects on pig performance, meat quality, and muscle characteristics. Journal of Animal Science, 82: 209-217.

Groesbeck CN, Goodband D, DeRouchey JM [2010]. Using heart girth to determine weight in finishing pigs". Report of progress 897, Kansas State University. Agricultural Experiment Station and Cooperative Extension Service

Heyer A [2004]. Performance, carcass and meat quality in pigs. Influence of rearing system, Breed and feeding. Doctoral Thesis. Department of Food Science, Uppsala.

Huyen LTT, Roessler R, Lemke U and Valle-Zarate A [2005]. Impact of the use of exotic compared to local pig breeds on socio-economic development and biodiversity in Vietnam. Beuren, Stuttgart

Ironkwe MO and Amefule KU [2008]. Appraisal of Indigenous Pig Production and Management Practices in Rivers State, Nigeria. Journal of Agriculture and Social Research [JASR] 8[1]:1 – 7.

Jensen JC, Nielsen LH, Arnason T and Cracknell V [2002]. Elimination of Mange Mites Sarcoptes Scabiei var. suis from two naturally infested danish sow herds using a single injection regime with Doramectin. *Acta Veterinary Scandinavia*: 75-84.

Kumaresan A, Bujarbaruah KM, Pathak KA, Chhetri B, Das KS, Das A and Ahmed SK [2007]. Performance of pigs reared under traditional tribal low input production system and chemical composition of non-conventional tropical plants used as pig feed. *Short Communication*, 107[2-3]: 294-298. *doi.org/10.1016/j.livsci.2006.12.007*

Mahanty S and Garcia HH [2010]. Cysticercosis and neurocysticercosis as pathogens affecting the nervous system. Progress in neurobiology, 91: 172–84.

McCosker L [2014]. Sarcoptic mange in pig: a review.

Mullaert MGG [2010]. In Vitro Efficacy of Absorbents to Trap Intrinsically Generated Lipopolysaccharides in Rumen Fluid of Dairy Cows. Subacute Ruminal Acidosis. Khonkaen University. Thailand.

Martínez-Miró S, Tecles F, Ramón M, Escribano D and Cerón J [2016]. Causes, consequences and biomarkers of stress in swine: an update. BMC Veterinary Research, 12: 171. DOI 10.1186/s12917-016-0791-8

Ten Napel J [2014]. Using Today's Technology for Breeding pigs for Tomorrow's conditions. Animal Breeding and Genomic Centre of Wageningen UR, The Netherlands.

Nasker S, Anubrata D, Prakash N, Khargharia G and Baishya SK [2003]. Comparative performance of crossbred and local pigs under village condition of Meghalaya [a case study]. Indian Journal of Animal. Resources, 37 [2]: 126·129

Nga NTD, Ninh HN, Hung PV and Lapar ML [2014]. Smallholder pig value chain development in Vietnam: Situation analysis and trends. ILRI Project Report. Nairobi, Kenya: International Livestock Research Institute [ILRI].

Nidup K, Tshering D, Wangdi S, Gyeltshen C, Phuntsho T and Moran C [2011]. Farming and Biodiversity of pigs in Bhutan. Animal Genetics Resources, 48: 47-61.

Phengsavanh P, Ogle B, Stür W, Frankow-Lindberg BE, Lindberg JE [2010]. Feeding and performance of pigs in smallholder production systems in Northern Lao PDR. Tropical Animal Health and Production 42: 1627–33.

Quac NK, Phung TV and Husssain GJ [1996]. Study on the physiological characteristics and reproduction of crossbred-sows F1 [Yorkshire x Mong Cai]. Agricultural Tropical University, 29: 59–64.

Quiniou N, Renaudeau D, Collin A and Noblet J [2000]. Influence of high ambient temperatures and physiological stage on feeding behaviour of pigs. Animal Productions, 13[4]: 233-245.

Rodriguez-Estevez V, Sanchez-Rodriguez M, Garcia AR and Gomez-Castro AG [2011]. Average daily weight gain of Iberian fattening pigs when grazing natural resources. Livestock Science, 292- 295. https://doi.org/10.1016/j.livsci.2010.11.015

Stupka K, Sprysl M and Pour M [2004]. The impact of sex on the economics of pig fattening. Czech University of Agriculture, Prague, Czech Republic, [5]: 217-222.

Thien N, Van PT, Le PN, Doanh PH, Nghi N, Quac NK and Hot VT [1996]. Improvement of productivity and meat quality of pigs in the Red River Delta region by crossbreeding. ACIAR, Canberra, Australia.

Thorne P [2005]. Pig Raising in Northern Lao PDR, Working Paper No.4. Asian Development bank PPTA No. 4287-490. Participatory Livestock Development Project, Lao PDR, CIAT, Vietnam.