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Assessment of Biosecurity Level in Pig and Poultry Production System in Vietnam Using Bio-check Technology

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ABSTRACT

Biosecurity is one of the main factors affecting disease occurrence and antimicrobial use. However, the importance of specific measures could vary depending on the national context. The objectives of this study was to describe the biosecurity status in the pig and poultry production systems in Vietnam using Biocheck technology. The project conducted surveys to collect information from 30 pig farms and 30 poultry farms in the Hanoi province and the Dong Nai province, Vietnam using the tool of the Biocheck.Ugent. The Biocheck.Ugent™ system for pig production and poultry production consists of a total of 109 and 79, mainly di- or trichotomous questions subdivided into six subcategories for internal biosecurity and six for external biosecurity. Every subcategory consists of 2-13 questions, where the answer to every question result in a score between 0 when this measure is not implemented and 1 when the measure is implemented. Depending on the importance of the measure the score per question is multiplied by a weight factor. Also, the subcategories have a specific weight factor to account for their assessed relative importance for disease prevention. The average over internal and external biosecurity results in a score for the total biosecurity. The result showed that internal and external biosecurity scores in pig farms are similar (55,05% and 53,68%, respectively). By contrast, in chickens farms the internal biosecurity score was higher than external biosecurity score (64,05% and 58,85%, respectively). For the external biosecurity of pig farms, the purchasing animal factor in the external biosecurity had a high biosecurity score, while some other factors had low scores such as vermin and bird control, personnel and visitors (people), environment and water resource. For the internal biosecurity of pig farms, some biosecurity factors had high fluctuations such as measure of animal and disease management. For chicken farms, the factors of one-day-old chick purchase, material supply and disease management had high biosecurity scores. Meanwhile, other factors such as entrance of visitors and personnel, removal of manure and dead animals, cleaning and disinfection were needed to improve biosecurity scores. The factors including supply of materials, and the managements of materials and measures between compartments have a big difference in scores. In conclusion, the analysis and assessment of biosecurity levels of surveyed pig and chicken farms in Hanoi and Dong Nai via biocheck.ugent tools show that all farms need to improve many factors in both internal and external biosecurity.

Keywords: Biosecurity, internal biosecurity, external biosecurity, pig production, poultry production, biocheck

INTRODUCTION

Biosecurity is one of the main factor affecting disease occurrence and antimicrobial use. It is the term used in (veterinary) medicine to describe measures to prevent pathogens from entering farm premises or a group of animals (external biosecurity) or the spreading of pathogens within farm premises or groups

of animals (internal biosecurity) (Amass and Clark. 1999), Different studies have shown positive associations between biosecurity and some animal production parameters (Laanen et al. 2013, Postma et al. 2016) and between biosecurity and farm profitability (Corrégé et al. 2012, Rojo-Gimeno et al. 2016). In addition, a higher biosecurity level had a positive impact on reducing the amount of antimicrobials (Laanen et al. 2013, Postma et al. 2016). It has been estimated that in the near future more people will die because of an infection with a resistant bacterial infection than of cancer (O'Neill. 2014). Therefore, antimicrobial use in both human medicine and livestock production and alternatives are becoming more and more of interest.

In Vietnam, pig and poultry production play important role. In 2018, there were 28.151 million pigs and 408.97 million chicken in Vietnam, producing 3.82 million tons of pork and 1.097 million tons of chicken meat accounting for 92 percent of the country's meat output (GSO. 2019). With the incursion of African Swine Fever (ASF) for the first time in 2019 and Avian influenza outbreak from 2003, Vietnam faces yet another challenge to its pig and poultry production sectors. Implementing biosecurity practices on livestock farms in Vietnam is having lot of difficulties due to many reasons such as regulatory system and management, geographic conditions, typical farming with small household situation and farmers' knowledge. The widespread use of antibiotics in livestock in Vietnam and poor management is a major risk factor which increases bacterial resistance. Some studies (Pham Ngoc Hieu et al. 2012, Dang Thi Thanh Son et al. 2017) were carried out on using antibiotics in pig production. The authors found that 100% of pig households used antibiotics for treatment. Many antibiotics were used by the pig owners at a dose of 0.5-2 times higher than the prescribed dose because this antibiotic was no longer effective in treating pigs if given the correct dose. however, there is no detailed description of how biosecurity is implemented Vietnamese pig and poultry production.

Improving the level of biosecurity on a farm will help to improve the health status of the animals and improving the health status will reduce the necessity of using antimicrobials or medicine in general. Furthermore, improving the level of biosecurity will improve the technical results of a herd. Improving the level of biosecurity can also be economically beneficial for a farmer since the technical results will improve on his farm and he will need less antimicrobials (Rojo-Gimeno et al. 2016). The interest in improving biosecurity in pig and poultry production has increased as awareness about the need for AM reduction to prevent the development of resistant bacteria has grown. In order to improve biosecurity at a national level, an assessment of biosecurity in detail is needed, so as to find weaknesses where there is potential for improvement. The objectives of this study were to describe the biosecurity status in the pig and poultry production systems in Vietnam using Biocheck technology based on interviews with the farmers.

MATERIAL AND METHOD

Selection of participating herds and herd visits

This study was cooperated with the Ha Noi and Dong Nai Department of Agriculture and Rural Development. An invitation to participate was sent out to Vietnamese farmers rearing pig or chicken in Ha Noi and Dong Nai province by local officials. The recruited herds were visited once during the period September to December 2018 by expert from Ghent University, Belgium and experts from the National Institute of Animal Science, Vietnam. A total of 30 chicken famers and pig were visited and interviewed. The Vietnamese experts were instructed on how to perform the visit/interview before the start of the study. The heads of the farms were interviewed.

Herd practices related to biosecurity

To evaluate the biosecurity in the herds, a tour around the farm was conducted. a preestablished. protocol, BioCheck (www.biocheck.ugent.be) was used. BioCheck was originally developed by Laanen et al. (2013) and consists of a total of 109 questions for pig and 79 for chicken, mainly di- or trichotomous questions subdivided into subcategories for internal biosecurity and for external biosecurity. Every subcategory consists of 2-13 questions. This risk-based scoring tool is designed to assess the level of both internal and external biosecurity and is currently already used in >50 countries. This tool was established and developed by the project team from Ghent University. During the survey, rural rapid appraisal (RRA) and participatory rural appraisal (PRA) methods were also used to collect data.

The Biocheck.UGent™ for pig farms consists of 6 subcategories for external biosecurity and 6 subcategories for internal pig biosecurity. Six subcategories regarding external pig biosecurity are: "Purchase of animals and semen"; "Transport of animals and removal of manure and dead animals";

“Feed, water and equipment supplies”; “Entrance of visitor and personal”; “Vermin and bird control”; and “The environment and region”. Six subcategories related to internal pig biosecurity are: “Disease management”; “The farrowing and suckling period”; “The nursery unit”; “The fattening unit”; “Biosecurity measures between compartments and the use of equipment”; and “Cleaning and disinfection”.

The Biocheck.UGent™ for poultry farms includes 8 subcategories for external biosecurity and 3 subcategories for internal biosecurity. Subcategories for external chicken biosecurity are: “Purchase of one day old chicks”; “Depopulation of broiler”, “Removal of manure and dead animals”; “Feed, water supplies”; “Entrance of visitor and personal”; “Supply of material” “Infrastructure and biological vectors”; and “Location of the farm”. Subcategories related to internal chicken biosecurity are: “Disease management”; “Material and measures between compartments and the use of equipment”; and “Cleaning and disinfection”.

Briefly, points were allotted for questions within the subcategories, with each given a weighting factor depending on its estimated importance for the introduction and spread of infectious diseases, as defined by Laanen et al. (2013) and Gelaude et al. (2014). The weights of the questions were subsequently combined into scores for each subcategory which were further weighted and combined into scores between 0 and 100 for internal and external biosecurity respectively, where 0 corresponded to “total absence of biosecurity” and 100 to “perfect biosecurity”, i.e. maximal possible biosecurity (Laanen et al. 2013). Finally, the mean of the scores for external and internal biosecurity was calculated as a whole-herd score.

All questions in the BioCheck form were translated from English into Vietnamese and questions about production parameters, preventive measures such as vaccination routines, and the educational level, gender and years of experience of the staff member responsible for pig and chicken management were also included. The questions were answered by the manager of the farm.

After the visit, data collected from the survey was analyzed using the Biocheck.Ugent (www.biocheck.ugent.be) which is a web-based scoring system using limesurvey. All factors affecting the levels of internal and external biosecurity in pig and poultry farms were analyzed and evaluated and then compared them with those of international averages.

RESULTS AND DISCUSSION

Pig Biosecurity

The biosecurity of pig was shown in the table 1.

Table 1. Score biosecurity of pig farms (%)

Category of biosecurity	subcategory	X	SD	MAX	MIN
External biosecurity	Purchase of animal and semen	83.64	14.60	100	52
	Transport of animals and removal of manure and dead animals	54.05	14.00	74	30
	Feed, water and equipment supplies	44.95	12.87	63	13
	Entrance of Personnel and visitors	28.82	25.97	82	0
	Vermin and bird control	40.91	13.77	70	20
	The environment and region	45.45	26.14	100	20
	Mean	53.68	7.47	69	41
	Internal biosecurity	Disease management	56.36	31.25	100
farrowing and suckling period		62.22	14.45	86	36
Nursery units		67.47	13.15	86	36
Fattening units		63.11	17.70	100	36
Measures between compartments and the use of equipment		36.64	14.56	71	14
Cleaning and disinfection		65.23	21.91	98	20
Mean		55.05	11.97	83	33
Total		54.51			

The external biosecurity subcategory that received the highest score was the purchase of animal (83.64%), while some other factors had low scores such as entrance of personnel and visitors (28.82%), vermin and bird control (40.91), feed, water and equipment supplies (44.95%), and environment and location (45.45%). For the Internal biosecurity, The highest score was nursery units (67.47%) while the lowest score was measures between compartments and the use of equipment (36.64%). Some subcategory had high fluctuations such as entrance of personnel and visitors or disease management as well as cleaning and disinfection.

Results assessed via biocheck.ugent tools showing that external and internal biosecurity scores in pig farms are 53.68% and 55.05% , respectively. The average score for external biosecurity in the present study was slightly higher compared with Belgian herds (52%) described in a recent study by Laanen et al.(2013) using the same scoring system, while our average scores for internal biosecurity were lower than the Belgian and Swised scores (Laanen et al. 2013, Backhand et al. 2015). Laanen et al. (2013) reported that the average score for external and internal biosecurity of pig farms in Belgium was 52% and 66%, respectively. Backhand et al. (2015) showed that the average score for external and internal biosecurity of Swedish pig farms was 68% and 59%, respectively

Postma et al. (2016) researching on the biodiversity of pig in the 4 European countries found that the average external biosecurity level and the internal biosecurity level of four countries was 65.5% and 55.7%, respectively. The external biosecurity was highest in Germany (70.2%) and lowest in France (59.4%), while the internal biosecurity level was highest in Sweden (58.8%) and lowest in Belgium (50.3%).

In compared to the average global biosecurity score, pig farms had a number of satisfactory subcategory such as cleaning and disinfection, nursery and farrowing units. However, the average external and internal biosecurity scores of surveyed pig and chicken farms were lower than the global average scores (Figure 1). It indicated that pig farmer put more attention on those two subcategories.

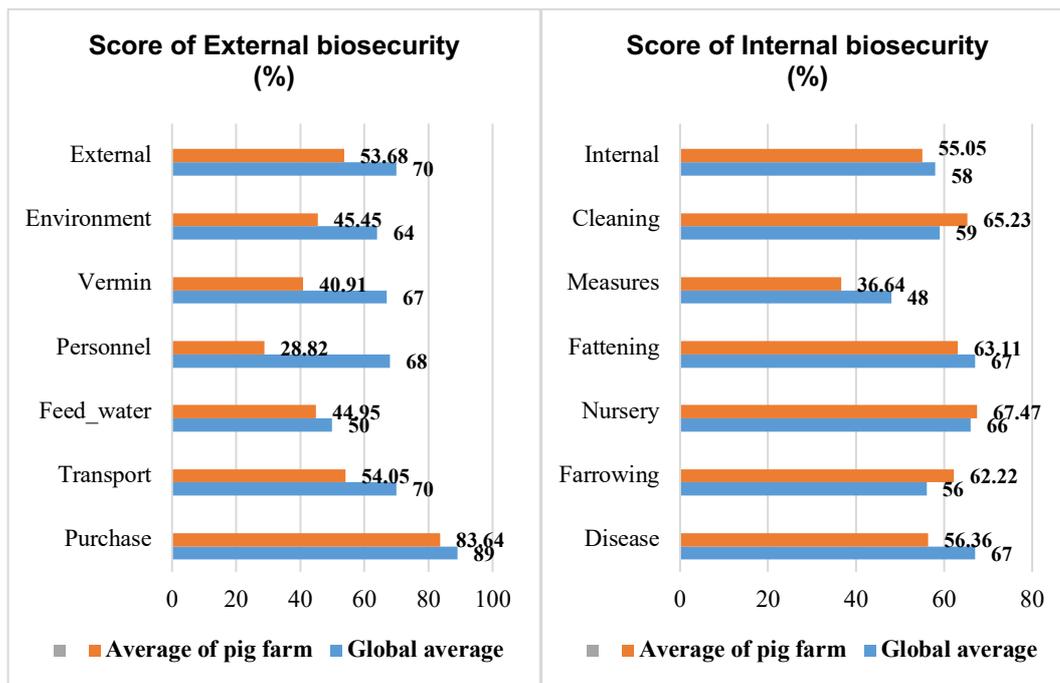


Figure 1. The average biosecurity scores of surveyed pig farms compared to the global average scores

Keynote: Purchase: purchase of animals and semen; Transport: transport of animals and removal of manure and dead animals; Feed_water: feed, water and equipment supplies; Personal: entrance of visitor and personal; Vermin: vermin and bird control; Environment: the environment and region. Disease: disease management; Farrowing: the farrowing and suckling period; Nursery: the nursery unit; Fattening: the fattening unit; Measure: measures between compartments and the use of equipment and Cleaning: cleaning and disinfection.

Chicken biosecurity

The biosecurity of chicken farms was shown in the table 2

Table 2. Score biosecurity of chicken farms

Category of biosecurity	Subcategory	X	SD	MAX	MIN
External biosecurity	Purchase of one day old chicks	82.45	15.21	100	40
	Depopulation of broiler	72.7	17.85	100	35
	Feed, water supplies	31.1	19.39	88	3
	Removal of manure and dead animals	19.85	17.14	65	5
	Entrance of visitor and personal	56.05	17.98	90	36
	Supply of material	84.6	21.53	100	56
	Infrastructure and biological vectors	61.65	20.74	92	11
	Location of farm	55.4	24.14	100	30
	Mean	58.85	10.46	88	42
	Internal biosecurity	Disease management	81.55	16.59	100
Measures between compartments and the use of equipment		51.95	15.98	100	16
Cleaning and disinfection		61.4	27.77	100	29
Mean		64.05	10.81	83	45

Table 2 showed that for the external chicken biosecurity, the subcategory with the highest score was supply of material (84.6%), and purchase of one day old chicks (82.45%), followed by depopulation of broiler (72.7%) and infrastructure and biological vectors (61.65%). The subcategory with the lowest score was removal of manure and dead animals (19.85%), followed by feed, water supplies (31.1%). For internal chicken biosecurity, the subcategories "Disease management" scored the highest mean scores (81.55%), while "Measures between compartments and the use of equipment" scored the lowest (51.95%). The subcategories including supply of materials, and the managements of materials and measures between compartments have a big difference in scores. The result indicated that the subcategories of entrance of visitors and personnel, removal of manure and dead animals, cleaning and disinfection were needed to improve biosecurity scores. The subcategories including supply of materials, and the managements of materials and measures between compartments in some poultry farmer still have to enhance.

The results showed that although chicken farms were selected on a voluntary basis, a large variation was found between the biosecurity scores of the different farms, showing that, despite the fact that the poultry production sector is sometimes perceived as one of the most advanced sectors of animal production in relation to biosecurity, there is still a lot of improvement possible.

Results assessed via biocheck.ugent tools showing that internal and external biosecurity scores in the chickens farms the internal biosecurity score was higher than external biosecurity score (64.05% and 58.85%). Similar results were found in the study of Van Steenwinkel et al. (2011) and Gelaude et al. (2014). Gelaude et al. (2014) showed that the internal and external biosecurity were 73% and 64%, respectively.

The difference between the external and internal biosecurity scores in poultry farms can be partly explained by the fact that there are less preventive measures for external biosecurity in comparison with the internal biosecurity. Therefore, high scores reaching the maximum score of 100% can be more easily obtained for internal biosecurity.

In compared to the average global biosecurity score, chicken farms showed 4 subcategories which are higher than the global biosecurity including purchase of one day old chicks, supply of material, depopulation of broiler and disease management - for chicken farms). However, the average external and internal biosecurity scores of surveyed pig and chicken farms were lower than the global average scores (Figure 2).

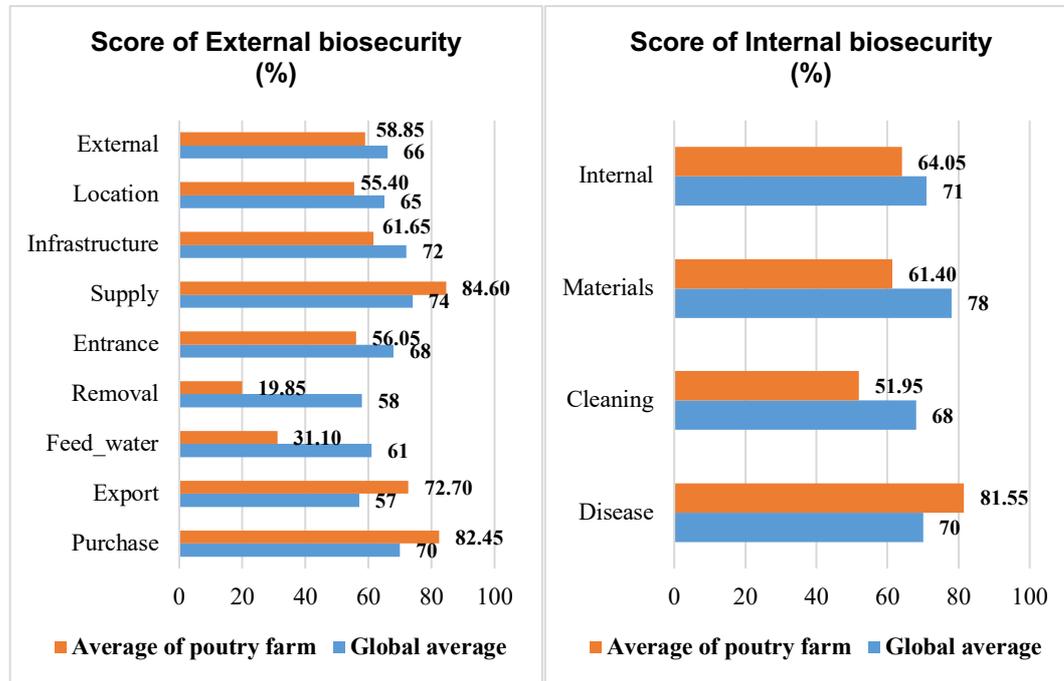


Figure 2: The average biosecurity scores of surveyed chicken farms compared to the global average scores

Keynote: Purchase: purchase of one day old chicks; Export: depopulation of broiler; Removal: removal of manure and dead animals; Feed_water: feed, water supplies; Entrance: entrance of visitor and personal; Supply: supply of material; Infrastructure: infrastructure and biological vectors and Location: location of the farm. Disease: disease management; "Material and measures between compartments and the use of equipment"; and "Cleaning and disinfection".

This innovative tool allows us to study, in a quantitative manner, the relationship between biosecurity, health, and production characteristics, as has recently also been done for poultry and pig production (Laanen et al. 2013, Van Steenwinkel et al. 2014 and Gelaude et al. 2014)). This type of study is of great importance to be able to demonstrate in an objective and quantitative manner the importance of biosecurity measures in preserving the health of animals.

CONCLUSION AND RECOMENDATION

In general, the analysis and assessment of biosecurity levels of surveyed pig and chicken farms in Hanoi and Dong Nai via biocheck.ugent tools shows that all farms need to improve many subcategories in both internal and external biosecurity.

More pig and poultry farmers should include in the future projects and the results on the relationship between biosecurity and antimicrobial use, and further research should be performed to investigate whether biosecurity can have a large effect on antimicrobial use or not.

REFERENCES

- Amass, S.F. and L.K. Clark. 1999. Biosecurity considerations for pork production units. *J Swine Health Prod* 7(5): 217-228.
- Backhans A., Sjölund M, Lindberg A and Emanuelso U. 2015. Biosecurity level and health anagement practices in 60 Swedish farrow-to-finish herds. *Acta Veterinaria Scandinavica* (2015) 57:14.
- Corrégé, I., P. Fourchon, T. Le Brun and N. Berthelot. 2012. Biosécurité et hygiène en élevage de porcs: état des lieux et impact sur les performances technico-économiques. *Journées Recherche Porcine* 44: 101–102. Dehejia, R.H., Wahba, S., 2002. Pro.
- Gelaude P., Schlepers, M., Verlinden M., Laanen M., Dewulf J. Biocheck.UGent: A quantitative tool to measure biosecurity at broiler farms and the relationship with technical performances and antimicrobial use. *Poultry Science*, Volume 93 (11): 2740–2751.
- GSO - General Statistics Office Of Vietnam. 2019. Statistical yearbook 2018.
- Laanen, M., D. Persoons, S. Ribbens, E. de Jong, B. Callen, M. Strubbe, D. Maes, and J. Dewulf. 2013. Relationship between biosecurity and production/antimicrobial treatment characteristics in pig herds. *The Veterinary Journal* 198(2): 508–12. doi: 10.1016/j.tvjl.2013.08.029. Epub 2013 Sep 2.
- O'Neill, J. 2014. Review on Antimicrobial Resistance. *Antimicrobial Resistance: Tackling a Crisis for the Health and Wealth of Nations*. Prime Ministers Office.
- Postma, M., A. Backhans, L. Collineau, S. Loesken, M. Sjölund, C. Belloc, U. Emanuelson, E. Grosse Beilage, K.D. Stärk KD, J. Dewulf; and MINAPIG consortium. 2016. The biosecurity status and its associations with production and management characteristics in farrow-to-finish pig herds. *Animal*. 10(03): 478–89. doi:10.1017/S1751731115002487.
- Rojo-Gimeno, C., M. Postma, J. Dewulf, H. Hogeveen, L. Lauwers and E. Wauters. 2016. Farm-economic analysis of reducing antimicrobial use whilst adopting improved management strategies on farrow-to-finish pig farms. *Preventive Veterinary Medicine* 129: 74-87.
- Van Steenwinkel, S., S. Ribbens, E. Ducheyne, E. Goossens, and J. Dewulf. 2011. Assessing biosecurity practices, movements and densities of poultry sites across Belgium, resulting in different farm risk-groups for infectious disease introduction and spread. *Preventive Veterinary Medicine* 98(4): 259–270.

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