Prevalence of *bla*$_{TEM}$, *bla*$_{CTX-M}$ and *bla*$_{SHV}$ gene in *Escherichia coli* isolated from chicken meat and pork in butcher shop in Eastern region of Thailand during 2022 – 2024

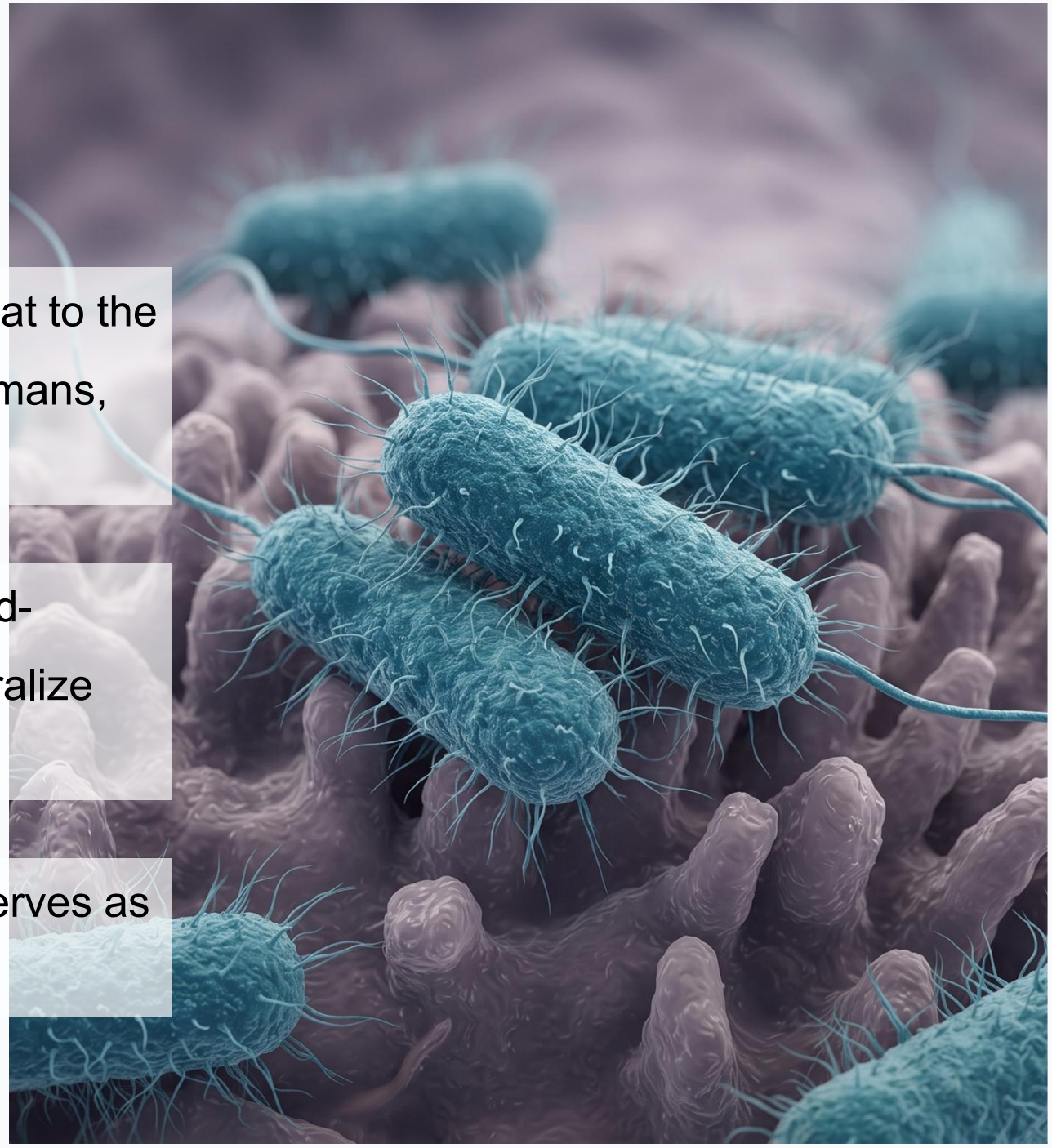
Phanlert Sakkaew, Nanticha Rattanamangkalanon ,Ruchuda Kanjanapen and Supaporn Wongsrichai
Veterinary Research and Development Center, Eastern Region, Chonburi, Thailand

AMR Threat & One Health

Antimicrobial resistance (AMR) is a severe threat to the global One Health ecosystem, endangering humans, animals, and the environment.

Escherichia coli (*E. coli*) that produce Extended-spectrum beta-lactamase (ESBL) actively neutralize critical antibiotics

Contaminated raw meat at retail checkpoints serves as a primary transmission vector to consumers.



Objectives

The prevalence of *bla*$_{TEM}$, *bla*$_{CTX-M}$ and *bla*$_{SHV}$ genes in *E. coli* isolated from chicken meat and pork butcher shops in each province in Eastern region of Thailand

To compare prevalence of ESBL producing - *E. coli* between modern butcher shops and local butcher shops

Sampling (N = 276)

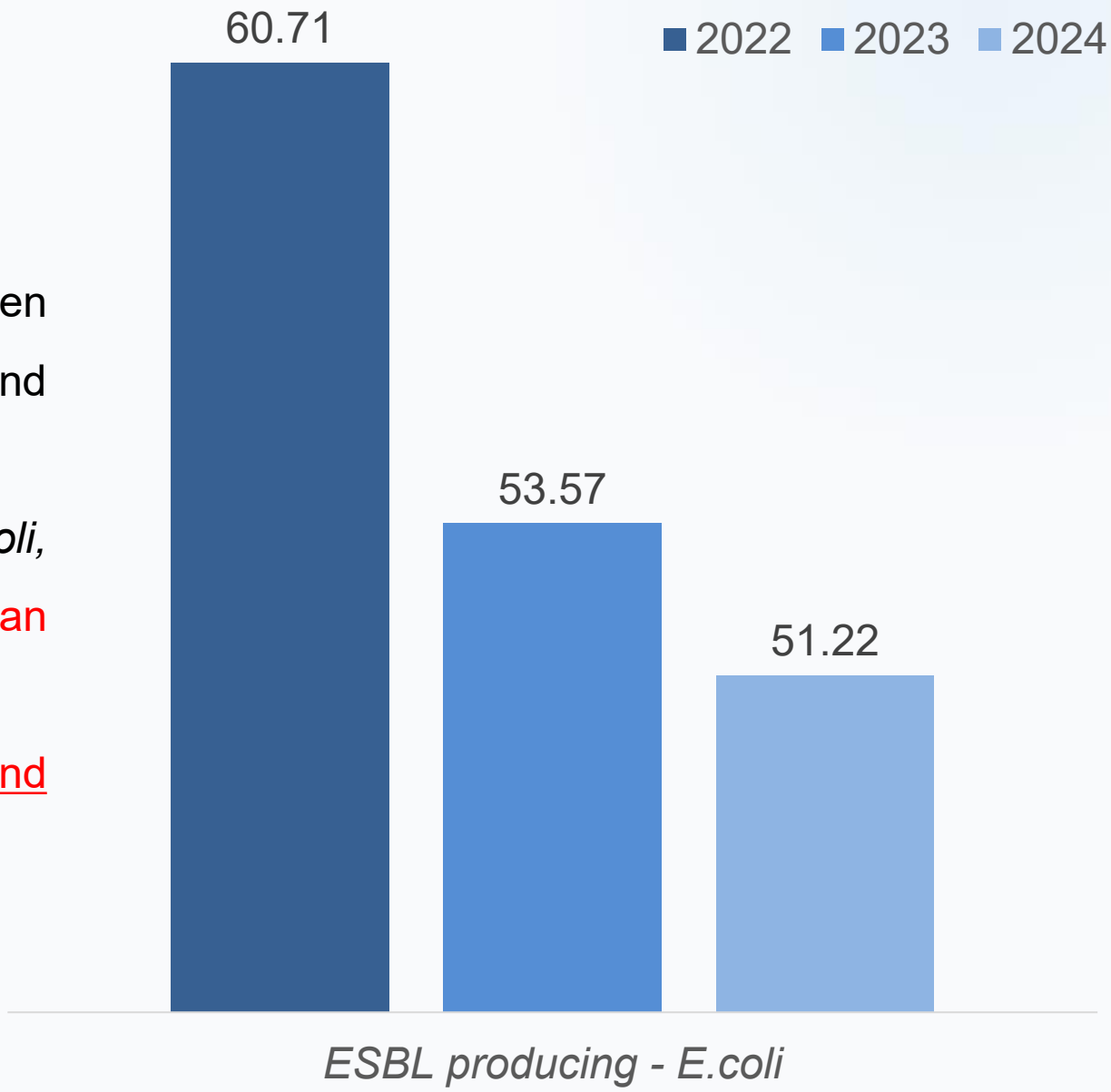
- ❑ chicken meat (n = 138)
- ❑ pork (n = 138)
- ❑ modern and local butcher shops in 9 provinces (Samutprakan, Chachoengsao, Chonburi, Prachinburi, Rayong, Sakaeo, Chanthaburi, Trat and Nakhonnayok)
- ❑ June 2022 – July 2024

Material and method

1. Bacterial culture
2. Biochemical test
3. ESBL screening (CLSI, 2023)
4. DNA extraction
5. PCR
6. Descriptive analysis

Result

- The ESBL producing – *E. coli* percentage of chicken meat and pork in 2022 (60.71%) 2023 (53.57%) and 2024 (51.22%).
- Pork was detected more ESBL producing - *E. coli,* bla_{TEM}, bla_{CTX-M} and bla_{TEM} with bla_{CTX-M} gene than chicken meat.
- Interestingly, none of the provinces were found bla_{SHV} gene.



Result : *ESBL producing – E. coli*

Province	*ESBL producing - E. coli* (%)								
	Total	Chicken meat			Total	Pork			Total
		2022	2023	2024		2022	2023	2024	
Chonburi	48.61	14.29	14.29	50	36.11	42.86	71.43	63.64	61.11
Samutprakan	53.45	66.67	16.67	47.06	44.83	83.33	66.67	52.94	62.07
Rayong	62.5	0	0	70	62.50	100	100	70	81.25
Chachoengsao	70	100	0	66.67	60	100	100	66.67	80
Sakaeo	62.5	100	100	33.33	66.67	100	0	66.67	58.33
Chanthaburi	20	0	100	0	20	50	50	0	20
Prachinburi	45	50	100	16.67	40	50	100	33.33	50
Trat	70	100	100	33.33	60	100	100	66.67	80
Nakhonnayok	60	0	0	66.67	40	100	100	66.67	80

Result : *Chicken meat*

Province	*bla*$_{TEM}$			*bla*$_{CTX-M}$			*bla*$_{TEM}$ and *bla*$_{CTX-M}$		
	2022	2023	2024	2022	2023	2024	2022	2023	2024
Chonburi	14.29	0.00	45.45	0.00	14.29	27.27	0.00	0.00	27.27
Samutprakan	16.67	16.67	23.53	50.00	0.00	35.29	16.67	0.00	17.65
Rayong	0.00	0.00	70.00	0.00	0.00	40.00	0.00	0.00	40.00
Chachoengsao	0.00	0.00	44.44	100.00	0.00	33.33	0.00	0.00	11.11
Sakaeo	66.67	100.00	16.67	33.33	0.00	33.33	0.00	0.00	16.67
Chanthaburi	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Prachinburi	0.00	0.00	0.00	50.00	100.00	16.67	0.00	0.00	0.00
Trat	100.00	0.00	33.33	0.00	100.00	33.33	0.00	0.00	33.33
Nakhonnayok	0.00	0.00	33.33	0.00	0.00	66.67	0.00	0.00	33.33

Result : *Pork*

Province	*bla*$_{TEM}$			*bla*$_{CTX-M}$			*bla*$_{TEM}$ and *bla*$_{CTX-M}$		
	2022	2023	2024	2022	2023	2024	2022	2023	2024
Chonburi	28.57	57.14	50.00	14.29	14.29	63.64	0.00	0.00	50.00
Samutprakan	33.33	16.67	47.06	33.33	50.00	47.06	0.00	0.00	41.18
Rayong	66.67	0.00	30.00	33.33	100.00	60.00	0.00	0.00	30.00
Chachoengsao	33.33	66.67	33.33	66.67	33.33	66.67	0.00	0.00	33.33
Sakaeo	33.33	0.00	33.33	66.67	0.00	66.67	0.00	0.00	33.33
Chanthaburi	50.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Prachinburi	50.00	50.00	33.33	0.00	50.00	33.33	0.00	0.00	33.33
Trat	100.00	0.00	33.33	0.00	100.00	66.67	0.00	0.00	33.33
Nakhonnayok	100.00	100.00	33.33	0.00	0.00	66.67	0.00	0.00	33.33

Result : *modern vs. local butcher shops*

N = 210

(76%)

N = 66

(24%)

The detection of *ESBL – producing E coli b*etween modern and local butcher shops was not significantly different (p = 0.199)

Discussion

3 years of Pork more than Chicken meat

- ***bla*$_{TEM}$ and *bla*$_{CTX-M}$**

  (Health Policy and Systems Research on Antimicrobial Resistance (HPSR-AMR) Network, Ministry of Public Health)

  : AMR (Ampicillin) in 2023 (-2.3%), 2022 (1.2%), 2021 (6.6%) and 2020 (3.6%)

  : AMR (Cefotaxime) in 2023 (7.7%), 2022 (4.7%), 2021 (7.7%) and 2020 (9.8%)

  : AMR (Ceftazidime) in 2023 (1.4%), 2022 (3.6%), 2021 (N/A) and 2020 (4.4%)

- ***bla*$_{SHV}$** None in this study *but* 1.45% in pork from fresh market in Chieng Mai (Srichumporn et al., 2022)

Discussion

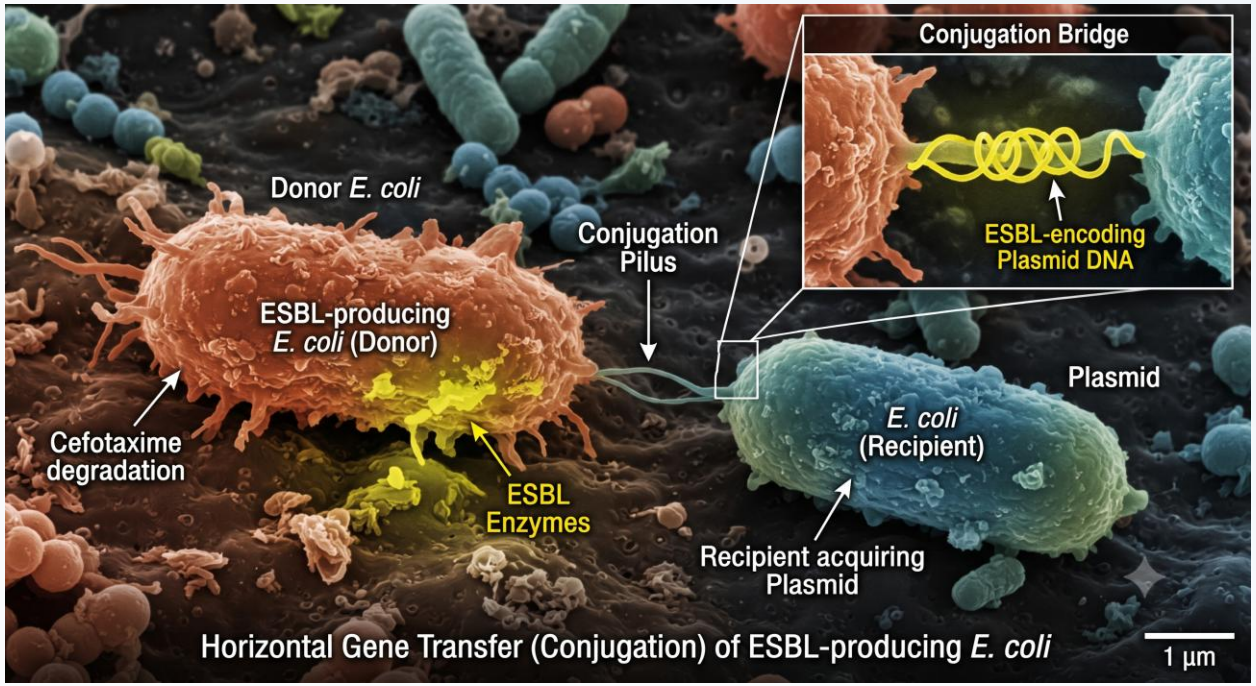
Cross contamination

- Horizontal Gene Transfer (HGT):Conjugation (*bla*$_{TEM}$ with *bla*$_{CTX-M}$)
- Slaughtering (Saenkankam et al., 2025; Langkabel et al., 2023; Trongjit et al., 2016; Boonyasiri et al., 2014)
- Butcher shop (Intongead et al., 2025; Ahmed et al., 2023; Ketkhao et al., 2019; Abayneh et al., 2019; Aliyu et al., 2016; Burgess et al., 2005)

Conclusion

Multiple resistance genes

- ❑ Horizontal Gene Transfer (HGT)



Public Health Management

- ❑ Good Agricultural Practices (GAP)
- ❑ Good Hygiene Practice (GHP)
- ❑ Hazard Analysis and Critical Control Point (HACCP)

Study Limitations

- **Sampling Constraints:** Sample collection was strictly limited by the operating hours of retail outlets, slightly reducing the temporal variety of the data collected.
- **Traceability Gaps:** A critical lack of traceback data to specific farms or slaughterhouses heavily limits upstream source tracking and localized interventions.
- **Future Research:** Future epidemiological studies must incorporate Whole-Genome Sequencing (WGS) to meticulously track specific strain transmission pathways and gene mutations.
- **Enforced Sanitation:** Routine sanitation protocols at all retail checkpoints must be rigorously enforced to completely minimize the risk of cross-contamination to consumers.

References

- สำนักงานพัฒนานโยบายสุขภาพระหว่างประเทศ กระทรวงสาธารณสุข. 2568. Health Policy and Systems Research on Antimicrobial Resistance (HPSR-AMR) Network Antimicrobial Resistance in Food-Producing Animal. แหล่งที่มา: https://www.thaiamrwatch.net /dashboard/antimicrobial-resistance-in-food-producing-animals. [28 พฤศจิกายน 2568]
- Abayneh, M., Tesfaw, G., Woldemichael, K., Yohannis, M. and Abdissa, A. 2019. Assessment of extended-spectrum ß -lactamase (ESBLs) - producing *Escherichia coli* from minced meat of cattle and swab samples and hygienic status of meat retailer shops in Jimma town, Southwest Ethiopia. *BMC infectious diseases*. 19(1): 897. doi: 10.1186/s12879-019-4554-6.
- Ahmed, H. A., Elsohaby, I., Elamin, A. M., El-Ghafar, A. E. A., Elsaid, G. A., Elbarbary, M., Mohsen, R. A., El Feky, T. M., and El Bayomi, R. M.. 2023. Extended-spectrum ß-lactamase-producing *E. coli* from retail meat and workers: genetic diversity, virulotyping, pathotyping and the antimicrobial effect of silver nanoparticles. *BMC microbiology*. 23(1): 212. doi: 10.1186/s12866-023-02948-0.
- Aliyu, A. B., Saleha, A. A., Jalila, A., and Zunita, Z. 2016. Risk factors and spatial distribution of extended spectrum ß-lactamase-producing-*Escherichia coli* at retail poultry meat markets in Malaysia: a cross-sectional study. *BMC public health*. 16: 699. doi: 10.1186/s12889-016-3377-2.
- Boonyasiri, A., Tangkoskul, T., Seenama, C., Saiyarin, J., Tiengrim, S., and Thamlikitkul, V. 2014. Prevalence of antibiotic resistant bacteria in healthy adults, foods, food animals, and the environment in selected areas in Thailand. *Pathogens and global health*. 108(5): 235–245. doi: 10.1179/2047773214Y.0000000148.
- Burgess, F., Little, C.L., Allen, G., Williamson, K., and Mitchell, R.T.. 2005. Prevalence of *Campylobacter*, *Salmonella*, and *Escherichia coli* on the External Packaging of Raw Meat. *Journal of Food Protection*. 68(3): 469-475. doi: 10.4315/0362-028X-68.3.469.
- Intongead, S., Saengsawang, P., Boonmar, S., Morita, Y., Mitsuwan, W., Narinthorn, R., and Boripun, R. 2025. Extended-Spectrum ß-lactamase-Producing *Escherichia coli* in Retail Pork and Market Environments: Genetic Diversity and Antimicrobial Resistance in Thailand. *Foodborne Pathogens and Disease*. 0(0). doi: 10.1089/fpd.2025.0045.
- Langkabel, N., Burgard, J., Freter, S., Fries, R., Meemken, D., and Ellerbroek, L. 2023. Detection of Extended-Spectrum ß -Lactamase (ESBL) *E. coli* at Different Processing Stages in Three Broiler Abattoirs. *Microorganisms*. 11(10): 2541. doi: 10.3390/microorganisms11102541.
- Saenkankam, I., Apiwatsiri, P., Supimon, N., Niyomtham, W., Hampson, D. J., and Prapasarakul, N. 2025. Tracking Extended-spectrum ß-lactamase-Producing and Colistin-Resistant *Escherichia Coli* in Pig Abattoirs: Impacts on Food Safety. *Foodborne Pathogens and Disease*. doi: 10.1089/fpd.2024.0178.
- Srichumporn, W., Chaisowwong, W., Intanon, M., and Na-Lampang, K. 2022. Extended-spectrum beta-lactamase-producing *Escherichia coli* from pork in Muang district, Chiang Mai Province, Thailand. *Veterinary World*. 15(12): 2903–2909. doi.org/10.14202/vetworld.2022.2903-2909.
- Trongjit, S., Angkittitrakul, S., and Chuanchuen, R. 2016. Occurrence and molecular characteristics of antimicrobial resistance of *Escherichia coli* from broilers, pigs and meat products in Thailand and Cambodia provinces. *Microbiology and Immunology*. 60(9): 575–585. doi: 10.1111/1348-0421.12407.

Thank you

BQCLP

- Supaporn Wongsrichai

Senior Professional Veterinary Officer

VRDC-ER

- Ruchuda Kanjanapen

Senior Professional Medical Scientist

- Nanticha Rattanamangkalanon

Professional Medical Scientist

- Staff member in Quality Control and Analysis of Livestock products section