UNIVERSITI PUTRA MALAYSIA

USAGE OF ANTIMICROBIALS AND EFFECTIVE MICROORGANISMS IN BROILER FARMS IN THE WEST COAST OF PENINSULAR MALAYSIA

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USAGE OF ANTIMICROBIALS AND EFFECTIVE MICROORGANISMS IN BROILER FARMS IN THE WEST COAST OF PENINSULAR MALAYSIA

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CERTIFICATION

It is hereby certified that I have read this project paper entitled "Usage of Antimicrobials and Effective Microorganisms in Broiler Farms in the West Coast of Peninsular Malaysia", by Yeo Yee Hein and in my opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement of the course VPD 4999 - Final Year Project.

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LIST OF ABBREVIATIONS

DOC	day-old chicks
DVS	Department of Veterinary Services
EM	Effective microorganisms
FCR	feed conversion ratio
FLFAM	Federation of Livestock Farmers' Associations of Malaysia
MyCC	Malaysia Competition Commission

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek Ilmiah Tahun Akhir.

PENGGUNAAN ANTIBIOTIK DAN MIKROORGANISMA EFEKTIF DI LADANG AYAM PEDAGING DI PANTAI BARAT SEMENANJUNG MALAYSIA

oleh

YEO YEE HEIN

2015

Penyelia : Prof. Datin Paduka Dr. Aini Ideris

Penggunaan antibiotik yang meluas di ladang telah menyumbang kepada kemunculan bakteria yang resistan terhadap antibiotik. Mikroorganisma efektif (EM) merupakan salah satu alternatif yang dicadangkan untuk menggantikan penggunaan antibiotik di ladang. Kajian ini bertujuan untuk menyelidik penggunaan antimikrobial dan EM di ladang ayam pedaging tempatan . Satu survei "cross-sectional" telah dilakukan secara rawak, melibatkan 24 ladang ayam pedaging yang terletak di Pantai Barat Semenanjung Malaysia. Kesemua 24 ladang didapati menggunakan sekurang-kurangnya satu jenis antibiotik untuk tujuan pencegahan dan rawatan. Amoxicillin (62.5%) merupakan antimikrobial yang paling kerap digunakan.

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Lapan ladang (33.3%) didapati menggunakan EM. Lima (66.3%) daripada 8 ladang tersebut didapati menggunakan EM melalui semburan pada najis ayam; manakala 3 ladang (37.5%) memasukkan EM ke dalam air minuman ayam. Tujuh (87.5%) penternak daripada 8 ladang tersebut mengatakan bahawa terdapat pengurangan bau najis ayam; manakala 3 (37.5%) penternak mendapati bahawa penggunaan EM menghasilkan najis ayam yang lebih kering. Kajian ini menunjukkan penggunaan antibiotik yang meluas berbanding dengan EM di ladang ayam pedaging tempatan. Terdapat keperluan untuk membentuk strategi bagi menggalakkan penggunaan antibiotik yang lebih rasional, atau mencari alternatif kepada penggunaan antibiotik di ladang ayam pedaging tempatan .

Kata kunci: Antibiotik, Mikroorganisma efektif, Ladang ayam pedaging, Pantai Barat Semenanjung Malaysia

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ABSTRACT

An abstract of the project paper presented to the Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 – Final Year Project.

USAGE OF ANTIMICROBIALS AND EFFECTIVE MICROORGANISMS IN BROILER FARMS IN THE WEST COAST OF PENINSULAR MALAYSIA

by

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2015

Supervisor : Prof. Datin Paduka Dr. Aini Ideris

There is a rising concern of usage of antimicrobials in farms as they contribute to the emergence of antibiotic resistance. Effective microorganisms (EM) is one of the proposed alternatives to antimicrobials. The aim of this study was to investigate the usage of antimicrobials and EM in local broiler farms. A cross-sectional survey was conducted in 24 randomly selected broiler farms in the West Coast of Peninsular Malaysia. All 24 farms use at least one antimicrobial agent, for both prophylaxis and treatment purposes. Amoxicillin (62.5%) is the most commonly used antimicrobial. Eight farms (33.3%) reported usage of EM. Out of the 8 farms, 5 farms (62.5%) reported usage of EM via spraying onto the feces of the chickens; while 3 farms (37.5%) added EM into the drinking water. Seven (87.5%) of the 8 farms reported a decrease in fecal odour due to the usage of EM; while 3 (37.5%) of the 8 farms reported drier chicken manure. This study indicated that

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antimicrobials are used more commonly as compared to EM in local broiler farms. There is a need for development of strategies to promote more rational and prudent use of antimicrobials, as well as the use of antimicrobial alternatives in local broiler farms.

Keywords: Antimicrobials, Effective microorganisms, Broiler farms, West Coast of Peninsular Malaysia

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1.0 INTRODUCTION

There is a rising concern of using antibiotics for prophylactic purposes and as growth promoters in farms as it contributes to the emergence of antimicrobial-resistance microorganism. Effective microorganisms (EM) is one of the alternatives used by farmers in the agricultural industry. EM was developed by Dr. Teruo Higa of the University of Ryukyus, Japan in the 1980s. EM is a mixture of photosynthetic bacteria, lactic acid bacteria, yeasts, actinomycetes and fermenting fungi (Higa & Wididana, 1991).

In Malaysia, there is increasing popularity of the usage of EM in poultry farms as an alternative growth promoter. However, limited publications are available on the usage of EMs and its proclaimed beneficial effects in the local poultry industry. Thus, there is a need for more studies to be done on the subject to gather information on the usage of EM and its effects in local broiler farms. Other than that, although there have been several reports on antimicrobial resistant bacteria in animals in Malaysia (Abu-Daud *et al., 2014;* Geidam *et al.*, 2012; Mansouri-najand *et al.*, 2012; Ooi *et al.*, 2011; Zunita *et al.*, 2008), limited studies had been done on the usage of antimicrobials in the farms. Thus, study should be done to gather more information on the usage of antimicrobials in local broiler farms.

Thus, the objective of this study is to investigate the usage of antimicrobials and EM in broiler farms in the West Coast of Peninsular Malaysia. This study also aims to determine the frequency, methods and impact of usage of EM and antimicrobials in broiler farms.

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2.0 LITERATURE REVIEW

2.1 Broiler Chicken Industry In Malaysia

The Department of Veterinary Services (DVS), Malaysia reported that in the year 2013, the per capita consumption of poultry meat in Malaysia was estimated to be 46.60kg and 103.6% self sufficient in poultry meat production. In 2012, there are a total of 2402 farms in Peninsular Malaysia (Table 1). Most of the farms are in Johor (23.2%), Perak (15.7%) and Kelantan (11.4%).

According to Federation of Livestock Farmers' Associations of Malaysia (FLFAM), the production of broilers in 2013 was 657.10 million birds; and the breeds of broiler chicken available in Malaysia consisted of Cobb (73.8%), Ross (19.5%), Abor Acres (6.3%) and Indian River (0.4%). In 2012, there were 23 broiler parent stock companies with 79 parent farms (Table 1), giving a standing parent stock population of about 5.91 million birds and a total production of 695.92 million day-old chicks.

Broiler chickens in Malaysia are kept in either open-house or closed-house systems. According to the Malaysia Competition Commission (MyCC, 2014), about 70% of broiler farmers use open-house system while the remaining farmers has changed to closed-house system. This is because closed-house system requires higher capital investment and operational cost. According to DVS (as cited in MyCC, 2014), the broiler farming cost structure includes day-old chicks (DOC, 21.0%),

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chicken feed (72.8%), vaccination and vitamins (1.0%), labour (2.6%), utilities (0.9%) and transportation (1.7%).

Table 1: Number of parent stock farms and broiler farms by state in 2012

State	Number of parent stock farms	Number of broiler farms
Perlis	0	13
Kedah	4	203
Penang	7	73
Perak	12	376
Selangor	3	202
Negeri Sembilan	11	193
Malacca	11	95
Johor	25	558
Pahang	2	178
Kelantan	1	274
Terengganu	3	237
TOTAL	79	2,402

2.2 Antimicrobials

Antimicrobial agents are commonly administered via feed and drinking water in poultry farms. Antimicrobial agents are used in animals for 3 main purposes, namely: therapeutic, (therapy and metaphylaxis), prophylactic, and growth promoting (Hofacre *et al.*, 2013; National Research Council, 1999; Schwarz *et al.*,

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2001). In commercial poultry farms, where the chickens are kept in large groups, it is impractical to carry out individual treatment. Instead, metaphylaxis, which is the mass treatment of the whole flock when only some of the chickens in the flock are showing clinical signs of disease, is more commonly done. This acts as a control measure to control the spread of the disease and decrease mortality; as well as to reduce the amount of antimicrobial drugs needed to treat large number of clinically unhealthy population and consequently the treatment cost (Schwarz *et al.,* 2001). Prophylaxis use of antimicrobial is a preventive measure, especially when a disease challenge is expected to occur.

Antimicrobials administered as growth promotants are antimicrobial agents such as clindamycin, lincomycin, vancomycin, spectinomycin, rifampicin, oxytetracycline, chlortetracycline, erythromycin, tylosin, flavomycin, virginiamycin and zinc bacitracin can significantly improve the growth rate of chicks (Bunyan *et al.*, 1977). The same study by Bunyan *el al.* (1977) also concluded that there is no relation between the growth-promoting properties of the various antimicrobials with their known antimicrobial and absorption characteristics in mammals.

In Malaysia, low dose of antimicrobial agent such as oxytetracycline, chlortetracycline or virginiamycin are added into broiler feed as antimicrobial growth promotant (Embong, personal communication, 2015). Other examples of antimicrobial growth promotants used in Malaysia are florfenicol, monensin and bacitracin (Ramachandran, personal communication, 2015).

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The widespread use of antimicrobial agents in both humans and animals has resulted in the emergence of antimicrobial resistant bacteria (Bogaard & Stobberingh, 2000; Doyle *et al.*, 2006; Schwarz *et al.,* 2001). In Malaysia, multi-drug resistant bacteria have been reported in food animal species including poultry (Daud et al., 2014; Geidam et al., 2012; Mansouri-najand *et al.,* 2012), swine (Ooi et al., 2011), and equine (Zunita et al., 2008).

This is a concern of public health as antimicrobial resistant bacteria can be passed to humans via direct contact, through the food chain during consumption of animal product, and environmental contamination (Marshall & Levy, 2011).

2.3 Effective Microorganisms

Effective microorganisms was developed by Dr. Teruo Higa of the University of Ryukyus, Japan in the 1980s. It is a mixture of photosynthetic bacteria, lactic acid bacteria, yeasts, actinomycetes and fermenting fungi (Higa & Wididana, 1991).

The methods of application include adding into the feed/drinking water, spraying onto the animal's shed/bedding or mixed in septic tank containing the feces (Takashi *et al.*, 1999).

EM added in feed significantly increased weight gain in broiler chickens (Lokapirnasari, 2007). Jwher *et al.* (2013) found that there was a positive significant

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effect of EM on the body weight, feed consumption and feed conversion efficiency of broiler chicks. Jwher *et al.* (2013) also reported increase in lymphocyte percentage, jejunal villus height, crypt depth and goblet cell count. In addition, Li and Ni (2001) also reported improved growth and disease resistance, as well as decrease in foul odour from the feces in birds supplemented with EM.

Esatu *et al.* (2011) reported that EM used in feed, water , or in both feed and water lowered total blood cholesterol significantly in broilers. Esatu *et al.* (2011) also reported lower feed conversion ratio (FCR) in broilers fed with EM in both feed and water; however, broilers fed with only EM in drinking water had the higher FCR as compared to the control group. In a study conducted by Safalaoh and Smith (2001), it was concluded that EM has growth promoting and hypocholesteremic effects; thus, EM is a potential alternative to antibiotics in broiler diets.

However, Simeamelak *et al.* (2012) reported no significant difference between EM treated group and the control group in feed consumption, chick growth, feed conversion efficiency and survival rate. Other than that, Cruz *et al.* (2013) found that treatment of litter using EM did not affect the performance, carcass yield and quality of the litter in broilers. A study done by Wondmeneh *et al.* (2011) found that EM supplementation had no observable effect on mortality, weight gain and FCR. EM supplemented in drinking water and/or feed showed no significant effect on production performance and carcass characteristics (Chantsavang & Watcharangkul, 1999).

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Another benefit claimed by adding EM either into drinking water, feed, or both was found to have markedly reduced the foul odour of poultry manure associated with ammonia (NH_3) levels (Li & Ni, 2001). This indirectly decrease flies population in the farm as the flies are actually attracted by the foul odour.

According to DVS, usage of EM is required for the application and renewing of license for broiler farms in the states of Johor, Melaka and Negeri Sembilan. The method recommended by the department is by spraying EM onto the feces or bedding of the animals, with the main purpose of reducing foul odour and fly population in the farms.

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3.0 MATERIALS AND METHODS

3.1 Study Population

The study was conducted in a total of 24 randomly selected farms in the West Coast of Peninsular Malaysia, including Johor (9 farms), Melaka (2 farms), Negeri Sembilan (3 farms), Selangor (1 farm), Perak (2 farms) and Kedah (7 farms). The informants were farm owners or the responsible farm managers.

3.2 Study Procedures

A cross-sectional survey was conducted from January 2015 to February 2015. The study was conducted during farm visits by interviewing the farm owners or managers using a questionnaire (Appendix A). The questionnaire was developed to fit the objective of this study. The questionnaire covered information on basic production data and management practices, with a focus on the usage of effective microorganisms and antimicrobial agents. The questions were open-ended and follow up was done when necessary.

3.4 Data Analysis

Data management and collation was done using Microsoft Excel. The states were categorized into 3 regions, namely Northern (Perlis, Kedah, Penang and Perak), Central (Selangor and Negeri Sembilan) and Southern (Melaka and Johor) for statistical analysis. Statistical analysis was done using Kruskal-Wallis test, followed by Mann-Whitney U-test with SPSS version 20 and significance value of $p = 0.05$.

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4.0 RESULTS AND DISCUSSION

A total of 24 farms were visited for this study. All the farms were owned by contract farmers. The population size of the farms ranged from 7500 to 70000 birds. Twenty two (91.7%) of the poultry farms are using open-house management system; while two (8.3%) are using closed-house system.

According to MyCC (2014), about 70% of the broiler farms in Malaysia are still using open-house system; while only 30% is using closed-house system. Although closed house system is more recommended, it is used less commonly due to the higher capital investment and operational costs (electrical fee).

4.1 Usage of Antimicrobial in Study Farms

All the 24 farms reported usage of at least one antimicrobial agent. Figure 1 shows the total number of antimicrobials used in the farms in the 3 regions. Average number of antimicrobials used in all the farms was 5.3; Southern region was 3.8; Central region was 8; and Northern region was 6. There was significant difference between the south and central region (P=0.03); but there was no significant difference between the South and Northern regions, or Central and Northern regions.

The lower average number of antimicrobial agents used in the southern region might be because the farms in that region are exporting part of their produce to Singapore, which has a strict regulation on usage and residue of antimicrobials in the meat imported into its country. The farmers might be using less antimicrobial agents in order to meet the requirement to export their products into Singapore.

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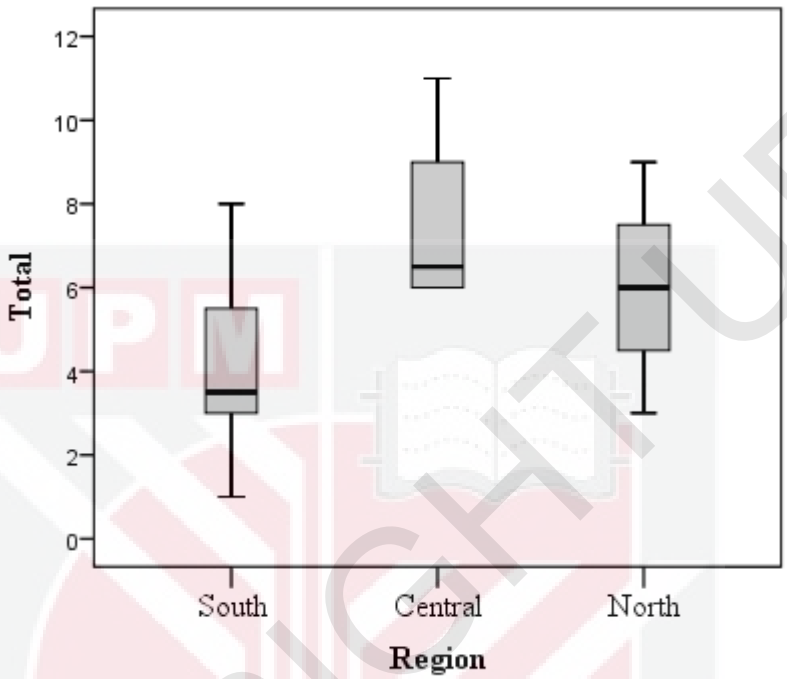
Figure 1: Total number of antimicrobials used per region.



A total of 19 antimicrobial compounds belonging to 11 classes were identified (Table 2). The most commonly used antimicrobial agent in the study farms was amoxicillin (62.5%), followed by tilmicosin (54.2%), tylosin (54.2%), florfenicol (45.8%), erythromycin (41.7%), colistin (41.7%) and methenamine (41.7%).

The route of administration of antimicrobial agents in all 24 farms (100%) was via drinking water. The course of antimicrobial use was typically 3 to 4 days. All the farms (100%) used antimicrobials for both prophylaxis and therapeutic purposes. According to the farmers, prophylactic use of antimicrobials was usually done during the first 3 – 5 days when the chicks arrived at the farm, as well as after

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vaccination when the birds are immunosuppressed after being challenged by the live attenuated vaccine.

4.2 Usage of Effective Microorganisms in Study Farms

Majority of the farms (66.7%) were not using EM; while 8 farms (33.3%) reported usage of EM. There was significant difference between the Central and Northern regions (P=0.007), and the Southern and Northern regions (P=0.04); but there was no significant difference between the Southern and Central region.

The result is summarized in Figure 2. For the Northern region, all of the farms (100%) involved in this study did not use EM. For the Central region, 3 farms (75%) used EM while 1 farm (25%) did not. As for the Southern region, 5 farms (41.7%) used EM while 7 farms (58.3%) did not.

None of the farmers of the farms involved in this study from the Northern region had heard of EM before. The farmers might not have access to the information. Another possible explanation is because the usage of EM is not required by the DVS in the northern region. Even though it is part of the regulation for EM to be used in the farms in the Southern region, 58.3% of the farms did not use EM. The farmers were not convinced on the efficacy of using EM and only kept a bottle of EM in the farms to show the DVS officers during farm inspections.

Figure 2: Usage of effective microorganisms per region.

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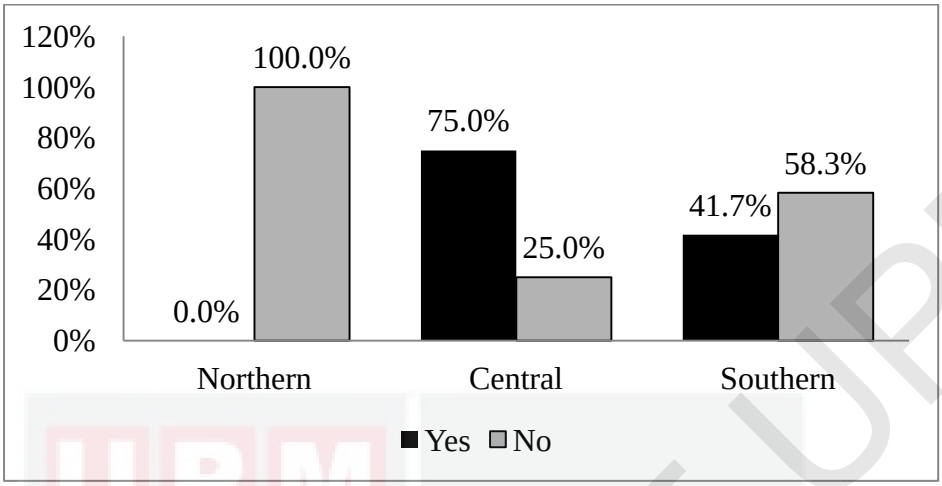

Out of the 8 farms that used EM, 5 farms (62.5%) reported usage of EM via spraying onto the feces of the chickens; while 3 farms (37.5%) added EM into the drinking water. The reason EM is used more commonly via spraying onto the feces might be because that is the method being recommended by DVS.

Seven (87.5%) out of the 8 farms that used EM reported a decrease in fecal odour; while 3 farms (37.5%) reported that usage of EM resulted in drier chicken manure, which is more desirable for the farmer. None of the farms reported improvement in performance of the chickens.

The decrease in fecal odour reported by the farms achieved the objective of DVS in promoting the use of EM. It is also consistent with the finding of Li and Ni (2001). It is understandable that no farms reported improvement in performance of the chickens as the chickens had no contact with the EM used. Majority of the farms kept the chickens in open-house system consisting of raised slatted flooring, and most of the farms sprayed EM onto the feces that fell through the flooring.

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Table 2: Antimicrobial agents used in the poultry farms.

Classes of antibiotics	Antibiotics	Number of farms (%)
Aminoglycosides	Streptomycin	3 (12.5)
	Neomycin	3 (12.5)
	Gentamicin	2 (8.3)
	Spectinomycin	1 (4.2)
Amphenicols	Florfenicol	11 (45.8)
Cephalosporins	Cephalexin	8 (33.3)
Lincosamides	Tilmicosin	13 (54.2)
	Lincomycin	1 (4.2)
Macrolides	Tylosin	13 (54.2)
	Erythromycin	10 (41.7)
Penicillins	Amoxicillin	15 (62.5)
Peptides	Colistin (polymyxin E)	10 (41.7)
	Fosfomycin	7 (29.2)
	Polymyxin B	1 (4.2)
Quinolones	Enrofloxacin	6 (25.0)
Sulfonamides	Sulfadiazine/Trimetoprim	3 (12.5)
	Sulfachlorpyridazine	2 (8.3)
Tetracyclines	Doxycycline	9 (37.5)
Others	Methenamine	10 (41.7)

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5.0 CONCLUSION

Antimicrobials are used more commonly as compared to EM in 24 broiler farms in the West Coast of Peninsular Malaysia. Usage of EM helps in controlling foul odour in the farms. However, the small sample size in this study might not represent the usage of EM and antimicrobials in the boiler industry in Malaysia.

6.0 RECOMMENDATIONS

The sample size and the region surveyed should be increased to better represent the broiler industry in Malaysia. Surveillance of antimicrobial resistance of selected bacterial species in broiler farms should also be carried out simultaneously to complement the result from the survey of antimicrobial usage.

Evaluation of the economic impact in using EM, antimicrobials, as well as EM and antimicrobials in combination should also be done.

In addition, it is recommended to encourage farmers to keep proper record of on-farm antimicrobial use for easier monitoring.

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APPENDIX

APPENDIX A

Questionnaire: Effective Microorganisms (EM) Study in Broiler Farms

Section A: About the Farm

1. Name of the farm:

2. Location of the farm:

3. What is the management of the farm?

   ☐ Closed house ☐ Open house

   ☐ Deep litter ☐ Slatted floor

4. Total no. of birds:

5. No. of birds per house:

House									
No. of birds									

6. Vaccination

Type of Vaccination	Frequency

7. What is the feed used in the farm?

_____

_____

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8. Are supplements the used in the farm? If yes, what are the supplements?

   i.

   ii.

   iii.

   iv.

9. Are medications used in the farm? If yes, what are the medications?

   i.

   ii.

   iii.

   iv.

10. History of the farm (Current/previous disease problem in the farm)

    _____

    _____

    _____

    _____

11. Is effective microorganism (EM) used in the farm?

    ☐Yes ☐No

12. If no, what is reason of not using EM?

    _____

If EM is used in the farm, please proceed to section B.

If EM is NOT used in the farm, please proceed to section E.

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Section B: Use of Effective Microorganisms

1. What is the type of EM used?

   ☐Commercially available ☐Self-cultured

2. What is the dosage or dilutions used?

   _____

3. When is EM used?

   _____

4. What is the frequency of EM used?

   _____

5. How is the EM used?

   ☐In feed ☐In drinking water ☐In litter ☐Others:_____

6. What is your opinion on the advantage and effectiveness of using EM?

   _____

   _____

7. What is your opinion on the challenges of using EM?

   _____

   _____

If the EM used in the farm is commercially available, please proceed to section C.

If the EM used in the farm is self-cultured, please proceed to section D.

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Section C: Commercial Effective Microorganisms

1. What brand/preparation of EM is used?

   _____

2. What is the content of EM used?

   _____

3. How much is the cost of EM used per bird per batch?

   _____

Please proceed to section E.

Section D: Self-cultured Effective Microorganisms

1. How is the EM prepared?

   _____

   _____

2. How frequent is the EM need to be prepared?

   _____

3. How much is the cost of EM used per bird per batch?

   _____

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Section E: Use of Antibiotics

1. Is antibiotic used in the farm?

   ☐Yes ☐No

2. If no, what is reason of not using antibiotics?

   _____

3. If yes, what is the purpose of using antibiotics? List the antibiotics used.

☐ As prophylaxis	☐ As prophylaxis
a)	a)
b)	b)
c)	c)
d)	d)
e)	e)

4. How much is the cost spent on antibiotics per bird per batch?

   _____

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APPENDIX B

Some of the effective microorganisms products used in the farms.

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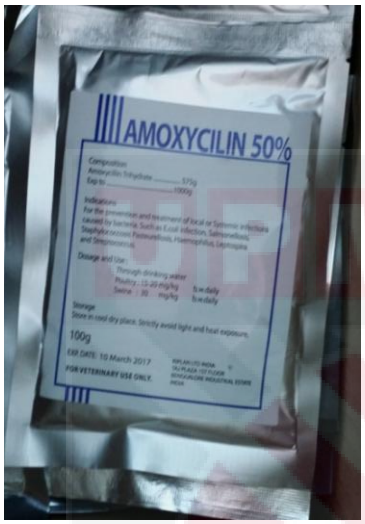
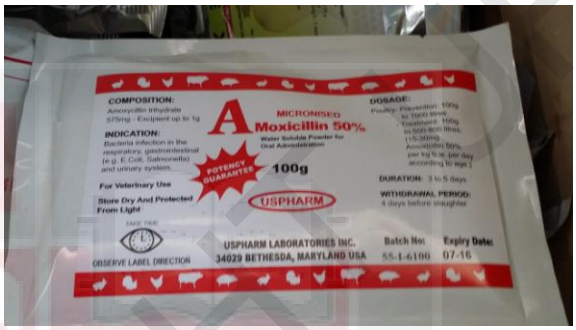
APPENDIX C

Some of the antimicrobial products with the same active ingredient used in the farms.

a) Amoxicillin





b) Florfenicol

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c) Methenamine

d) Fosfomycin and tylosin

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