

**13<sup>th</sup> Proceedings**  
of the **Seminar**  
on

**VETERINARY  
SCIENCES**

Faculty of Veterinary Medicine, UPM  
20 - 22 February 2018



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## Preface

The rate of information generation in this modern age is unbelievable. This is mainly attributable to the availability of frontier technologies that are beyond our imagination just two decades ago. These technologies had resulted in numerous new and innovative ideas and products that benefited humans and animals. The need to contribute new information also holds true for the veterinary field. Veterinarians need to keep pace with current developments. In fact, it is the onus of veterinarians to contribute to the development of veterinary science through research and new findings.

The doctor of veterinary medicine programme is compact, with dissemination of information mainly through interactions between instructors and students. Unfortunately, most veterinary curriculums, may be because of time constraint, do not generally cater for independent scientific investigations. The Faculty of Veterinary Medicine, Universiti Putra Malaysia is among the few veterinary schools that incorporates independent research into the curriculum. We are very pleased to note that this exercise had served to instill into our veterinary students that knowledge is not just from printed materials and classroom instructions, but also from laboratory and field investigations. This proceedings is a testament to the commitment and research and investigative abilities of our veterinary students.

The editors wish to express gratitude to and congratulate students and staff for successfully completing and reporting findings from their Final Year Projects in this 13th Proceedings of the Seminar on Veterinary Sciences. We are thankful to the Dean and management of the Faculty for facilitating and funding the publication of this proceedings.

### **Editors**

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## **RETROSPECTIVE STUDY ON EQUINE CASES REFERRED TO UNIVERSITY VETERINARY HOSPITAL, UNIVERSITI PUTRA MALAYSIA FROM YEAR 2013 TO 2017**

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### **ABSTRACT**

An increase number of equine clinical cases reported to the University Veterinary Hospital (UVH), Universiti Putra Malaysia (UPM) was observed. Therefore, a retrospective study was done in order to determine the prevalence of equine cases referred to UVH, UPM for the past five years as well as to identify different clinical problems in horses from different horse usage and management practice in relation to its occurrence rate. Data of equine clinical cases referred to UVH from year January 2013 to December 2017 were gathered and recorded. A total of 4,577 equine cases were recorded and analyzed based on case number, horse establishment, type of work and clinical problems. The total of cases recorded in year 2013 including revisit cases was 877 (19.16%), year 2014 was 1,049 (22.92%), year 2015 was 1,026 (22.42%), year 2016 was 955 (20.86%) and year 2017 was 670 (14.64 %). The highest cases reported involved the musculoskeletal (34.34%), followed by traumatic injuries (14.57%) and gastrointestinal tract problems (10.23%). The data collected provide a valuable resource to investigate the post-operative management by horse owners.

**Keywords:** retrospective study, equine cases

### **INTRODUCTION**

Malaysia is one of the countries that host several annual international horse competitions. These events have developed great interest in the sport among Malaysians. As a result, more horses are being imported by equine establishments for that purpose and for riding schools. In Malaysia, government bodies mainly use horses for patrolling and ceremonial events.

Horse management includes control and treatment of diseases. Horses are commonly affected by diseases and disorders of the musculoskeletal system, colic, upper respiratory tract infection, and fly bite hypersensitivity. With the increase in number of equine events in the country, the incidence of these diseases and disorders are increasing (Bashir A., 1993). This is reflected by the increase in equine clinical

cases referred to University Veterinary Hospital (UVH), Universiti Putra Malaysia (UPM).

The purpose of this study was to determine the prevalence of equine cases referred to UVH, UPM and to identify clinical problems in the horses.

## MATERIALS AND METHODS

### *Medical records*

This retrospective study was conducted by obtaining records of equine cases referred to UVH, UPM from January 2013 until December 2017. Among information compiled were horse identification, establishment, and clinical problems. The clinical problems were grouped according to body system/organ affected and specific diseases or disorders. Addition information on competitions and clinicians and groomers.

### *Data Analysis*

The data was analyzed using descriptive statistics using IBM SPSS version 24.0 (SPSS software for Windows, IBM Corp).

## RESULTS AND DISCUSSION

A total of 4,577 equine clinical cases recorded for the period chosen for the study. The frequency of cases presented to UVH. UPM for the years 2013 to 2017 is presented in Table 1.

**Table 1.** Frequency of equine cases presented to University Veterinary Hospital, Universiti Putra Malaysia for the five-year period.

Years	Case frequency		
	New	Revisit	Total
2013	616	261	877 (19.16%)
2014	676	373	1049 (22.92%)
2015	558	468	1026 (22.42%)
2016	575	380	955 (20.87%)
2017	438	232	670 (14.63%)

The highest numbers of equine cases recorded were for year 2014 and 2015.

The equine cases according to system, diseases and disorder is presented in Table 2.

**Table 2.** Diseases and disorders affecting horses referred to University Veterinary Hospital, Universiti Putra Malaysia

<b>Specific Problems</b>	<b>Number of cases</b>
<b>Musculoskeletal</b>	
Non-specific musculoskeletal problem	440 (9.61 %)
Foot problem	380 (8.30 %)
Back pain	117 (2.56 %)
Tendinitis / Joint problem	325 (7.10 %)
Lymphangitis	196 (4.28 %)
Myositis	35 (0.76 %)
Fracture	31 (0.68 %)
Saddle sore	28 (0.61 %)
Cellulitis	20 (0.44 %)
<b>Total</b>	<b>1572 (34.34 %)</b>
<b>Integumentary</b>	
Hypersensitivity	149 (3.26 %)
Cutaneous myiasis	82 (1.79 %)
Proud flesh	80 (1.75 %)
Habronemiasis	64 (1.40 %)
Dermatophilosis	19 (0.42 %)
Queensland itch	18 (0.39 %)
Dermatophytosis	17 (0.37 %)
<b>Total</b>	<b>429 (9.37 %)</b>
<b>Gastrointestinal</b>	
Colic	406 (8.87 %)
Diarrhea	62 (1.35 %)
<b>Total</b>	<b>468 (10.23 %)</b>
<b>Systemic</b>	
Inappetance / Poor body condition	106 (2.32 %)
Thumps / Metabolic	52 (1.14 %)
Pyrexia	13 (0.28 %)
Heat stress	13 (0.28 %)
<b>Total</b>	<b>184 (4.02 %)</b>
<b>Others</b>	
Traumatic injury	667 (14.57 %)
Herd health problem	445 (9.72 %)
COPD / Epistaxis	196 (4.28 %)
Reproductive problems	170 (3.71 %)
Eye problems	156 (3.41 %)
Neurological: Wobbler	25 (0.55 %)
Ear	20 (0.44 %)
Urinary tract infection	15 (0.33 %)
Miscellaneous	230 (5.03 %)

There no significant pattern in the prevalence of equine cases presented to UVH for the 5-year period of the study. However, the highest frequency of cases was in 2014 and 2015 and the lowest in 2017.

During the period of the study, 35 establishments, 21 private (2105 cases) and 14 (2472 cases) government bodies, referred their horses to UVH.

Based on body system, musculoskeletal problems were the highest complaints, followed by gastrointestinal and skin problems. In spite of the high incidence of musculoskeletal problems among these horses, that is not the main cause of motility; in fact, the main cause of equine deaths was colic. Non-specific musculoskeletal problem has the highest rate of occurrence followed in order by foot and joint problems. The non-specific musculoskeletal problems were mild and treated symptomatically without additional diagnostic workout. Hence, there was no final diagnosis for these cases.

The occurrence of musculoskeletal problems was higher in private than government equine institutions. Horses in government institutions were chosen and imported from countries like Australia and Germany, ridden, and cared by professionals. These horses are used routinely and had a high level of fitness; thus, they had less tendency to developed musculoskeletal problems. Most private institutions were riding schools and their horses, mostly retired racehorses, were mostly ridden by amateurs. It is possible that these inexperience riders could have been the cause of the horses developing musculoskeletal problems.

The main foot problems in horses referred to UVH were hoof crack, thrush, sole abscess, stone bruise, and tendonitis.

There was no significant difference in the occurrence of gastrointestinal problems between horses from government and private institutions. This finding may be due to the similarity in the diet and dietary management of the horses in these institutions.

Skin hypersensitivity is among the complaints in horses referred to UVH. Malaysia is a tropical country with hot and humid weather condition all year round. This environmental condition is a predisposing factor for horses to develop skin diseases. Among the prevailing causes of skin hypersensitivity were habronemiasis, Queensland itch, and dermatophytosis infection or ringworm (Macura, 1993; Pugh et al., 2014; Jones, 2018)).

## **CONCLUSION**

From this study, it is concluded that the high number of equine cases presented to UVH, UPM from the period of 2013 to 2017 is due increased interest in equine sports over the last few years. It is postulated that frequent participation in competition by the horses is one of the main factors for the high incidence of clinical problems in Malaysian horses.



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## **ANTIMICROBIAL ACTIVITY OF HONEY FROM FOUR SPECIES OF MALAYSIAN STINGLESS BEES, *TRIGONA APICALIS*, *TRIGONA CARNIFRONS*, *TRIGONA ITAMA*, AND *TRIGONA THORACICA***

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### **ABSTRACT**

Antimicrobial resistance (AMR) has become a very important public health issue worldwide due to indiscriminate use of antimicrobials which eventually leads to failure of treatment such as in infected wounds cases. Honey from Apis bee and Meliponines (stingless honey bees) has been reported to have antimicrobial property. Recent development in stingless bee keeping in Malaysia has generated great interest. This study aimed to determine the antimicrobial activity of fresh honey from four species of Malaysian stingless bees, namely, *Trigona apicalis*, *Trigona carnifrons*, *Trigona itama* and *Trigona thoracica*. A well-diffusion assay was used to assess the antimicrobial activity of the four honeys against seven bacteria commonly found on infected wounds. The diameters of zone of inhibition (ZDI) of the four honeys determined against *Bacillus subtilis*, *Enterococci faecalis*, *Escherichia coli*, *Pasteurella multocida*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus* were 0 to 29.3, 0 to 21.5, 0 to 31.9, 24.3 to 40, 0 to 21.3, 7 to 21, and 10.6 to 30.7 mm, respectively. Although there is no significant difference in effect, all tested honeys showed antimicrobial activity.

**Keywords:** antimicrobial, honey, *Trigona*, stingless bee, well-diffusion assay, bacteria, pathogenic, wound

### **INTRODUCTION**

Honey is a thick liquid produced by bees, made of nectar from flowers. As indicated by the Stone Age painting in the Rana Cave, Edwin Smith Papyrus, an ancient Egyptian medical text, and Compendium of Materia Medica, honey has been both used as food and medicine for at least 8000 years. According to Pasupuleti et al. (2017), honey is one the most effective natural products used for wound healing, which is attributed to the low pH, osmotic effect, high sugar content, and presence of

the bacteriostatic and bactericidal factors, hydrogen peroxide, antioxidants, lysozyme, polyphenols, phenolic acids, flavonoids, methylglyoxal, and bee peptides (Israili, 2014).

The excessive and indiscriminate use of antibiotics over the past decades had caused development of multidrug resistant that has become a global public health problem (Mandal and Mandal, 2009). Hence, there is need for alternative antimicrobial compounds such as the use of honey that will not cause propagation of antimicrobial resistance (AMR) bacteria. Stingless and *Apis* bee honeys was reported to possess antimicrobial properties and promote healing (Abd Jalil et al., 2016). According to Mussafeer and Zunita (2015), the stingless bee honey, based on the minimum inhibition concentration (MIC), is a more effective antibacteria compound than manuka, propolis, polyfloral, or artificial honey. However, research on the Malaysian stingless bee honey as an antibacterial compound is limited. Thus, this study was conducted to explore the medicinal property of local stingless bee honey through the determination of the antimicrobial activity of honey from four species of Malaysian stingless bees namely *Trigona apicalis*, *Trigona carnifrons*, *Trigona itama*, and *Trigona thoracica*.

## MATERIALS AND METHODS

### *Honey samples*

Seven honey samples each were from *Trigona apicalis*, *Trigona carnifrons*, *Trigona itama*, and *Trigona thoracica* obtained from Mentakab, Pahang, Malaysia, were used in this study. The honey samples were freshly harvested, bottled and kept in dark and cold area before the experiment. An aliquot from each of the honey samples was transferred into a small glass beaker as the working solution.

### *Bee specimens*

One bee specimen each from the four selected species was collected for identification and confirmation using stereo- and light microscopes and the manual “Key to workers of Indo-Malayan stingless bee” (Malaysian Agricultural Research and Development Institute (MARDI, 2012), as reference

### *Physiochemical study*

The appearance of the honeys was evaluated visually and the pH was determined by using a calibrated digital pH meter probe.

### *Bacterial isolates*

Seven bacteria commonly isolated from wound cases submitted to the Bacteriology Laboratory, Faculty of Veterinary Medicine, Universiti Putra Malaysia were selected for this study. The bacteria were *Bacillus subtilis*, *Enterococci faecalis*, *Escherichia coli*, *Pasteurella multocida*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The isolates were then sub-cultured onto blood agar and incubated at 37°C for 24 h. Laboratory biochemical tests were performed to re-confirm the bacterial strains. The bacteria plates were then stored at 4°C before use.

### *Bacterial isolates preparation*

McFarland standard was employed to standardise bacterial concentration in this study. A 0.5 McFarland pre-prepared standard was used as the standard to achieve a solution containing approximately  $1.5 \times 10^8$  colony forming unit per ml (cfu/mL).

### *Well-diffusion assay*

Well-diffusion assay was selected to determine the antimicrobial property of the stingless bee honeys (Khalil et. al., 2014; Jiavendrasingh, 2015). Generally, two Mueller-Hilton (MH) plates were used for each bacteria strain of bacteria with each plate containing two wells made with a 6 mm-diameter sterile cork borer. The plates were streaked with  $1.5 \times 10^8$  CFU/mL inoculum in 3 different directions using sterile swabs. Then, 60  $\mu$ L honey samples were pipetted using negative displacement pipetting method and placed in the allocated wells. Enrofloxacin disc as positive control and a blank disc inoculated with sterile saline as the negative control were placed onto the plate using sterile forceps. The plates were then incubated at 37°C for 24 h and the diameter of zone of inhibition (ZDI) measured using a Vernier calliper.

### *Data Analysis*

The ZDI data were recorded and analysed in the Statistical Software for Social Sciences (SPSS), Version 20 (IBM, New York, United States). Descriptive statistics of the ZDI were first computed for all data. Normality of data was determined based on Kolmogorov-Smirnov (KS) statistics at  $\alpha=0.05$ . Analysis of variance (ANOVA) was used to compare the means.

## RESULTS AND DISCUSSION

The ZDI for bacterial growth is shown in Table 1.

**Table 1.** Descriptive statistics for the zone diameter of inhibition data of the four tested honeys against the tested bacteria

Honey	Zone Diameter of Inhibition (mm)							
	N	Mean	SD	SE	95% Confidence Interval		Min	Max
					Lower Bound	Upper Bound		
<i>T. apicalis</i>	7	10.8	8.9	3.4	2.5	19.1	0	25.3
<i>T. carnifrons</i>	7	12.9	8.6	3.3	4.9	20.9	0	27.2
<i>T. itama</i>	7	10.1	7.4	2.8	3.3	17.0	0	24.3
<i>T. thoracica</i>	6	17.5	3.4	1.4	13.9	21.0	11.5	21.3
<b>Total</b>	<b>27</b>	<b>12.7</b>	<b>7.6</b>	<b>1.5</b>	<b>9.6</b>	<b>15.7</b>	<b>0</b>	<b>27.2</b>

Four species of stingless bees were identified as *Trigona apicalis*, *Trigona carnifrons*, *Trigona itama* and *Trigona thoracica*. The honey samples were from light to dark brown in colour with pH of at least 2.83. the highest and lowest mean ZDI was recorded for *T. thoracica* at  $17.5 \pm 3.4$  mm and *T. itama* at  $10.1 \pm 7.4$  mm, respectively.

The results showed no significant difference on effect on ZDI among honeys. One of the possible reasons for this observation is that the content and source of nectar collected by the bees are same all four species of bees came from the same farm. The small sample size may have also contributed to the insignificant findings. Nevertheless, further studies are warranted future exploration into the potential of local stingless bee honeys as antibacterial agents.

## CONCLUSION

In conclusion, our study showed that honey from the Malaysian stingless bees *T. apicalis*, *T. carnifrons*, *T. itama* and *T. thoracica* may have antibacterial property against bacteria commonly found on infected wounds, namely *Bacillus subtilis*, *Enterococci faecalis*, *Escherichia coli*, *Pasteurella multocida*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

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## **EFFECT OF *SACCHAROMYCES CEREVISIAE* SUPPLEMENTATION IN FEED AS PROBIOTIC FOR SOWS AND PIGLETS**

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### **ABSTRACT**

In general, diarrhea is the most common cause of high morbidity and mortality in newborn piglets. Formerly, antibiotic was the most efficient and effective method to cure diarrhea, until the existence of antimicrobial resistance comes into view. The overall objective of this study evaluated the effect of *Saccharomyces cerevisiae boulardii* (SB), a probiotic yeast strain supplementation, on the average daily gains (ADG) and the fecal scores of piglets as well as the fecal coliform count of sows between treatment and control groups. SB supplementation plays an important role in regulating micro-flora in GIT tract of sows and piglets. In this study, 10 sows were randomly selected from a commercial swine farm in Tanjung Sepat, Selangor. SB supplementation was given on day-100 of late gestation until day-28 before piglets were weaned for the treatment group. The average daily gains (ADG) and fecal scores of piglets as well as fecal coliform count of sows were measured upon birth, 14- and 28-day old. The results showed that there was no significant difference in average daily gains (ADG) and fecal scores of piglets as well as fecal coliform count. Further research is required to refine the products and conditions of use in order to ensure effective and consistent results.

**Keywords:** *Saccharomyces cerevisiae* boulardii (SB), yeast probiotic, average daily gain (ADG), fecal score, fecal coliform count

### **INTRODUCTION**

Diarrhea is one of the biggest issues in pigs especially during the neonatal and post-weaning stages. This is due to poor disease resistance, gastrointestinal disorder and environmental stress thus causing major economic losses in the farming industry. In the past, antibiotic is the most common method to treat pig diseases in the farm. Nonetheless, when the emergence of antimicrobial resistance (AMR) comes into view, the usage of antibiotics has to be reduced and even banned in a number of countries (Kim & Valientes, 2016). Thus, the role of probiotic becomes important nowadays. Although probiotics have been commercialized and available for more than 50 years, the documented evidence of its therapeutic and nutritional value has been quite variable (Holden, et al., 2002). The possible causes of lacking consistency in the results included variable viability of microbial cultures, strain differences in

cultures selected, dosage, frequency of administration, feed ingredient interactions and the farming environment. In this study, the effect of *Saccharomyces cerevisiae boulardii* (SB) yeast product as probiotic supplement was discussed. There are numerous studies on SB product or other similar yeast strain products; however, most of the studies were conducted in temperate country setting instead of tropical countries environment. Therefore, this study will be able to provide a preliminary result about the usage of SB product in a tropical farm environment.

## MATERIALS AND METHODS

A closed house, intensive-based, two sites with approximately 800-sow population swine farm located in Tanjung Sepat, Selangor was selected for this study. A total of 10 sows were randomly selected from the farm, which were divided into treatment and control groups. The treatment group sows were fed with *Saccharomyces cerevisiae boulardii* (SB) supplement daily, starting from 100<sup>th</sup> day of late gestation by the farmers. While the control group will have normal diet with no extra supplement. The following parameters were evaluated in this study:

### *Piglet average daily gain*

Calculated averaged daily gain were based on body weight measured at birth of the piglets at age at 14 days and 28 days using the following formula;

$$\text{Average Daily Gain (ADG)} = \frac{(\text{Final weight} - \text{Initial Weight})}{\text{Number of days to final weight}}$$

### *Piglet faecal scores*

The piglet faecal scores were determined according to the method described by Pedersen and Toft (2011). Litters scores 1 to 2 were classified as normal, while litters with fecal scores 3 to 4 were considered having diarrhea. For pens with no obvious fecal stains, piglets will be examined for clinical signs of diarrhea. Scoring was done daily for 6 days and graded based on the worst score observed in a litter.

### *Sow faecal coliform*

This parameter was determined using the 3M™ Petrifilm™ *E. coli* /Coliform Count Plates with modification for faecal samples. Faeces were collected from sows at 3 time points as follows; first day of farrowing (Day-0), 2 weeks after farrow (14 day-old), and 4 weeks after farrow (28 day-old)

### *Statistical analysis*

Data collected were recorded into IBM® SPSS Statistics version 22.0 and statistically analysed. Data that was normally distributed was subjected to Independent T-test, while data that was not normally distributed was subjected to Mann Whitney U-test; at 95% confidence level.

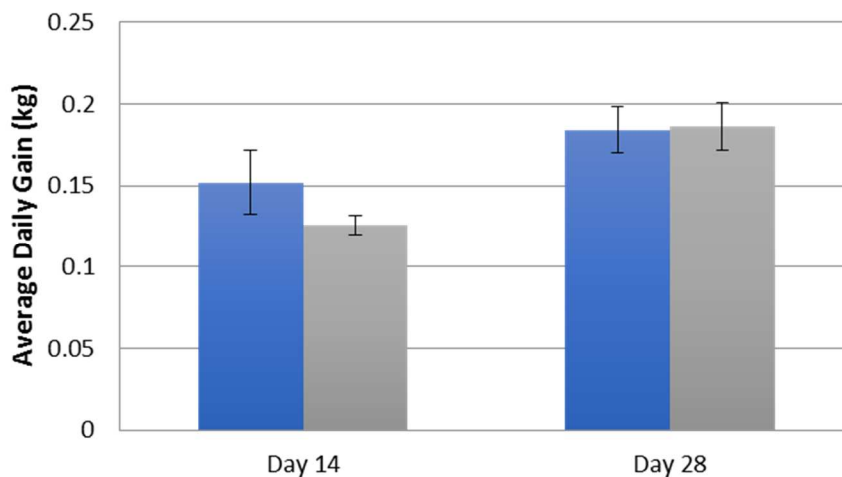
## RESULTS AND DISCUSSION

Based on the overall results of piglet growth performance, piglet fecal score and sow fecal coliform count, there was no statistically significant difference between treatment and control groups. This may indicate that the SB supplementation in sows might not have significant effect in terms of piglet growth performance (body weight gain, average daily gains, percentage of body weight gain), piglet fecal score and sow fecal coliform count in this study.

### *Piglet average daily gain*

The body weight of the piglets had similar findings in between treatment and control group; thus, the ADG of the both groups had no significant different. The ADG of treatment group was higher than the control group on day 14; however, on day 28, the ADG of treatment group is slightly lower than the control group. Based on statistical analysis, there was no significant difference between the ADG of the treatment and control group on day 14 and day 28 as well.

Dam parity showed to influence piglets' growth performance; in terms of body weight, average daily gain and average daily feed intake, which agreed with this study (Hinkle, 2012). The sow parity was not considered in the study, in which dam parity might affect the sow reproductive and piglet growth performance. Sows were selected from population based on availability (giving birth) during the research period.

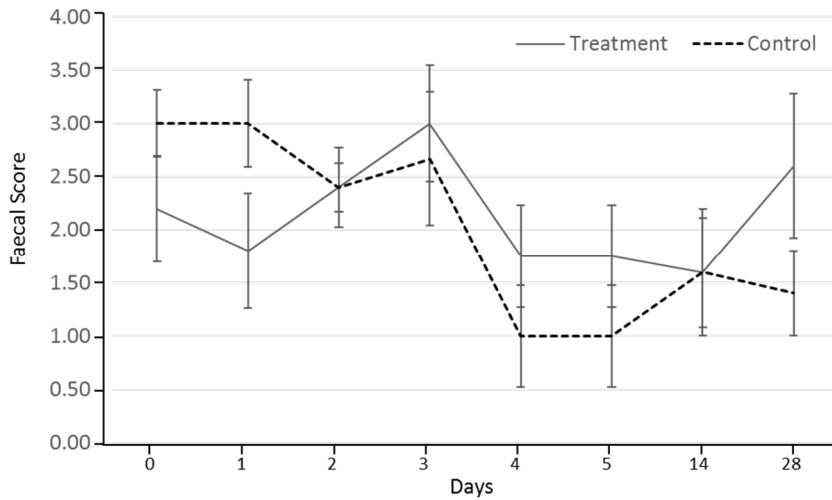


**Figure 1:** Effect of treatment on average daily gain (ADG) of piglets aged 14- and 28-day old.

### *Piglet faecal scores*

It was demonstrated that the control group had a higher score at starting of experiment as compared to treatment group. On Day 4 onwards, control group seemed to be having lower fecal score as compared to treatment group. Despite the differences, statistically it was still not significant.

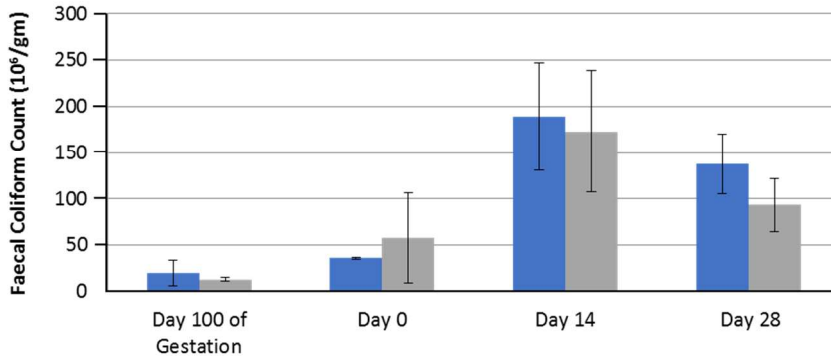




**Figure 3:** Average piglet faecal scores in treatment and control groups.

*Sow faecal coliform count*

Generally, all sow faecal condition observed remained normal at all time. Both control and treatment group shown similar coliform count pattern at all time points with slight difference. Based on statistical analysis, the difference is not significant.



**Figure 4:** Average faecal coliform count of sows.

Most of the SB product studies were conducted in temperate countries, mainly in European countries. The difference in temperature could be affecting the quality of the viable yeast cells and thus disrupt the outcomes of the study. Improper storage and hot climate might disrupt the performance and lifespan of live yeast products

(Vanhee et al., 2010). In addition, the SB product was a dry live yeast in powder or grain form and it is harder to be incorporated into feed, especially when the SB supplementation was not premixed thoroughly but manually topping up onto the feeds. This might interfere and restrict the performance of the SB product. As most of the studies on SB supplementation or similar yeast products in swine feeding were carried out in temperate countries that different breeds of sow were used in which there could be a certain level of variation in the performance. In local swine farms of Malaysia, commercial three-way-cross breed of Landrace, Duroc and Large White is raised commercially (Singh et al.).

## CONCLUSION

There was no significant difference in between the piglet growth performance including body weight gain, average daily gain and percentage of body weight gain; piglet fecal scores as well as sow fecal coliform count in this study. The outcomes of the experiment are not be extrapolated and applied to other similar studies on yeast supplementation of SB. Further research is required to refine the products and conditions of use in order to ensure effective and consistent results.

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## **ESTIMATING COSTS OF REARING AND MARKETING ASIAN SEAPERCH (*LATES CALCARIFER*, BLOCH) IN CAGE CULTURE FARM USING THE DETERMINISTIC MODEL**

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### **ABSTRACT**

Malaysia has projected that 1.9 million metric tonnes of fish will be demanded by year 2020. Yet, the number of captured fish landed became stagnant in recent years while 407,387.31 metric tonnes of fish were produced from aquaculture in 2016. Realizing the importance of the aquaculture industry in ensuring food security, the government has developed programmes such as the Aquaculture Industrial Zone to develop economically sustainable aquaculture farms. Currently, the aquaculture production costs at farm level in Malaysia is not clear. Thus, the objective of this study was to estimate the costs of rearing Asian seaperch (*Lates calcarifer*, Bloch) in cage-culture farms. A deterministic model was built in Microsoft Excel® assuming there were no major outbreaks. Estimation was performed on the rearing and production of 1.091 kg body weight Asian seaperch from fingerling weighing 3.7 to over 307 days based on the costs of feeding, labour, vibriosis, petrol, and maintenance. Biological inputs such as bodyweight and economic inputs such as feed price used were based on literature, survey, and expert opinion. The cost of rearing an Asian seaperch was estimated at RM13.09/kg. The net profit of rearing an Asian seaperch was estimated at RM2.01/kg. The costs are sensitive to feed price; therefore improvement of feed efficiency in farms is essential.

**Keywords:** aquaculture, marine cage culture, *Lates calcalifer*, cost

### **INTRODUCTION**

Demand for fish in Malaysia was predicted to increase by 1.93 million metric tonnes by 2020. The Malaysian government has come up with strategic plans such as the National Agro-food Policy 2011-2020 (Yusoff, 2015). Other than ponds, tank and pen culture, cage culture is among the popular methods in brackishwater aquaculture.

In 2009, the area of cage cultures in Malaysia increased to 1,741,000 m<sup>3</sup> from 27,000 m<sup>3</sup> in 1982 (DOF, 2011).

Cage culture farms are important as they are highly productivity and profitability. However, only 37% of cage cultures in Malaysia are technically efficient (Islam *et al.*, 2016).

In Malaysia, Asian seaperch (*Lates calcarifer*, Bloch) is one of the main fish produced from cage culture farms (DOF, 2016). Asian seaperch is a hardy fish as it is adaptable to various environmental conditions such as water salinity, changing water temperature, and rough handling. The fish is only fed pellets and can be easily cultured (FAO, 2013).

To reduce the costs of production, farmers need to understand the economics of farm production and fish health. For example, fish farmers need to rationally use its available resources, such as feed, to achieve the desirable market weight for higher economic benefits (Rushton, 2009). However, farmers in Malaysia are not fully aware of the costs of rearing an Asian Seaperch and this has hindered evaluation of farm profitability. Using the deterministic model, the costs of production of Asian seaperch can be estimated to support decisions on farm. The objective of this study is to estimate the costs of rearing the Asian seaperch in brackish-water cage-culture farms.

## MATERIALS AND METHODS

A deterministic model was built using Microsoft Excel®. The culture farm modele consisted of 40 cages, with an assumed standard size per net cage of 10 x 10 x 10 m. The stocking density of each cage was 1,000. It was also assumed that there was no major disease outbreak and no extreme fluctuation in environmental parameters such as temperature, salinity, pH, turbidity, ammonia, and nitrate.

The model was based on weekly stages from 90 (3.7 g) until 307 days of age when the fish reached 1 kg in body weight (Figure 1). Feeding was done twice a day, and cleaning and changing nets done monthly, and grading at 2nd, 3rd and 7th month of post-stocking. Bodyweight in the model was based that described by Anil *et al.*, 2010. The type of feed differed according to the post-stocking period. Petrol, maintenance, and vibriosis costs (Maryam *et al.*, 2015) were included from the estimation. The estimation was based on equations 1-17 below.

Rear period (mth)	Fish age (wk)	Fish age (d)	Bwt (g)	Bwt gain/wk	bwt gain/d	Bwt gain from pellet	Bwt gain from fish	FCR pellet	FCR trash fish	Amount of pellet eaten to gain weight (g)/wk	Amount of trash fish eaten to gain weight (g)/wk
1	1	7	3.7	1.4	0.2	1.4	0	2	0	2.8	0
	2	14	5.1	1.4	0.2	1.4	0	2	0	2.8	0
	3	21	6.5	1.94	0.28	1.94	0	2	0	3.88	0
	4	28	8.44	2.66	0.38	2.66	0	2	0	5.32	0
	5	35	11.1	2.66	0.38	2.66	0	2	0	5.32	0
	6	42	13.8	~	~	~	~	~	~	~	~
	7	49	16.4	~	~	~	~	~	~	~	~
	8	56	19.1	~	~	~	~	~	~	~	~
	9	63	24.5	~	~	~	~	~	~	~	~
	10	70	30	~	~	~	~	~	~	~	~
	11	77	35.5	6.33	0.9	6.33	0	2	0	12.66	0

Weekly steps  
 Examples of Important variables to estimate costs

**Figure 1:** Example of the model framework in Microsoft Excel® on a weekly basis with each column representing important variables used to estimate costs.

## Equations for variables in the model

$$\text{Bodyweight gain (per week) (g)} = \text{BW}_{t+7} - \text{BW}_t \quad \dots\dots\dots (1)$$

Where BW= Bodyweight (g)  
t = Age of fish

$$\text{Amount of feed attribution (pellet and trash fish) to bodyweight gain (per week) (g)} = \text{Att}_{t=i} \times \text{BW}_{t=i} \quad \dots\dots\dots (2)$$

Where Att<sub>t=i</sub> = Percentage of feed attribution at age t=i  
BW<sub>t=i</sub> = Bodyweight gain at age t=i (g)

$$\text{Amount of feed (pellet and trash fish) eaten/week (g) (FAMT)} = \text{FCR} \times \text{BWg} \quad \dots\dots\dots (3)$$

Where FCR= Feed conversion rate  
BWg= Bodyweight gain (g)

$$\text{Percentage of feed eaten per BW/day (Fperc)} = \frac{\text{FAMT} \times 100}{\text{BWT}} \quad \dots\dots\dots (4)$$

Where FAMT=Amount of feed eaten per day (g)  
BWT=Bodyweight (g)

$$\text{Total pellet costs per week (PC)} = \text{Pelletp} \times \text{PelletAMT} \quad \dots\dots\dots (5)$$

Where Pelletp= Pellet price per kg (RM)  
PelletAMT = Amount of pellet consumed (kg)

$$\text{Total trash fish costs per week (TFC)} = \text{TFP} \times \text{TFAMT} \quad \dots\dots\dots (6)$$

Where TFP=Trash fish price per kg (RM)  
TFAMT= Amount of trash fish consumed (kg)

$$\text{Total feed costs (per week) (FC)} = \text{PC} + \text{TFC} \quad \dots\dots\dots (7)$$

Where PC= Pellet costs per week (RM)  
TFC=Trash fish costs per week (RM)

$$\text{Labour costs for grading (GLC)} = \frac{G_t \times \text{Wage}}{\text{Stock}_n} \quad \dots\dots\dots (8)$$

Where G<sub>t</sub>= Amount of time taken to do grading/cage  
Wage= Labour costs/seconds  
Stock<sub>n</sub>= Stocking density per cage

$$\text{Labor costs for feeding (FLC)} = \frac{F_t \times \text{Wage}}{\text{Stock}_n} \quad \dots\dots\dots (9)$$

Where  $F_t$ = Amount of time taken to do feeding/cage  
 Wage= Labour costs/seconds  
 $Stock_n$ = Stocking density per cage

$$\text{Total costs (Operating costs) (TC)} = FRC + FC + LC + VC \dots\dots\dots (10)$$

Where  $FRC$ =Fingerling price per tail (4 inch) (RM)  
 $FC$ =Total feed costs (RM)  
 $LC$ =Total labour costs (grading, cleaning net and feeding)  
 $VC$ =Vibriosis costs (RM)

$$\text{Petrol cost per tail (PetC)} = \frac{\text{PetP} / 30 \text{ days}}{\text{Stock}_n} \dots\dots\dots (11)$$

Where  $PetP$ =Petrol costs per month  
 $Stock_n$ = Stocking density per cage

$$\text{Maintenance cost per tail (MC)} = \frac{\text{MP} / 30 \text{ days}}{\text{Stock}_n} \dots\dots\dots (12)$$

Where  $MP$ =Maintenance costs per month  
 $Stock_n$ =Stocking density per cage

$$\text{Other expenses (EXPC)} = \text{PetC} + \text{MC} \dots\dots\dots (13)$$

Petrol cost + Maintenance cost  
 Where  $MP$ =Maintenance costs per month  
 $PetP$ = petrol costs per month

$$\text{Total revenue (TR)} = \text{FishP} \times \text{BWT} \dots\dots\dots (14)$$

Where  $FishP$ = Fish price/kg  
 $BWT$ =BWT (kg)

$$\text{Gross margin (Gross)} = \text{TR} - \text{TC} \dots\dots\dots (16)$$

Where  $TR$ =Total revenue  
 $TC$ =Total operating costs

$$\text{Net Revenue (Nett)} = \text{Gross} - \text{EXPC} \dots\dots\dots (17)$$

Where  $Gross$ =Gross margin  
 $EXPC$ =Other expenses

Biological and economic inputs used in the models are in Table 1 and 2.

**Table 1:** Biological inputs in the model

<b>Biological Inputs</b>	<b>Value</b>	<b>Sources</b>
Size of fingerling (inch)	4	Expert opinion
Bodyweight fingerling at stocking (g)	3.7	Expert opinion
Bodyweight of market size (g)	1,091	Expert opinion
Bodyweight gain per day (g)		Anil <i>et al.</i> , 2010
Feed Conversion Ratio pellet for <100g BW	2	Nik Sin, 2015
Feed Conversion Ratio pellet for >100g BW	3	Nik sin, 2015
Feed Conversion Ratio for trash fish	4	FAO, 2013
Labor work activities (1,000 stocks/cage)		
Clean/change net (sec/fish)	2.7	Farm survey (unpublished)
Feeding 2x (sec/fish)	0.8	Farm survey (unpublished)
Grading (sec/fish)	1.8	Farm survey (unpublished)

**Table 2:** Economic inputs used in the model.

<b>ECONOMIC INPUTS</b>	<b>VALUE (RM)</b>	<b>SOURCES</b>
Fingerling/tail	1.20	Farm survey (Unpublished)
Fish price/kg	15.32	Laporan minggu kelima, 2018
Pellet price/kg	5.68	Farm survey (Unpublished)
Trash fish price/kg	1.10	Farm Survey (Unpublished)
Labor wage/month	1,500	Farm Survey (Unpublished)
Maintenance cost/farm/year	650	Farm Survey (Unpublished)
Vibriosis cost/tail	0.385 <sup>1</sup>	Mustaffa Al-Adlan <i>et al.</i> , 2017 <sup>1</sup>
Petrol cos/farm/year	703	Farm Survey (Unpublished)

<sup>1</sup>Total cost of Vibriosis was estimated as sum of mortality cost, body weight loss cost and treatment cost

Sensitivity analyses were done for economic inputs such as prices (Table 3).

**Table 3:** Sensitivity analyses for economical inputs were done for the prices.

<b>Input Variables</b>	<b>Default Value (RM)</b>	<b>Value Changed (RM)</b>	<b>Sources</b>
Fingerling	1.20	-0.50; +0.30	Farm Survey
Trash fish (per kg)	1.1	-0.60; +2.40	Farm Survey
Pellet price (per kg)	5.68	-3.28; +7.32	Laporan minggu kelima, 2018
Labour wage (per month)	1,500	-300; +400	Farm Survey

## RESULTS AND DISCUSSION

The amount of feed needed to rear an Asian Seaperch from 3.7 g to 1 kg market bodyweight in 224 days is 4.2 kg as shown in table Table 4.

**Table 4:** Amount of feed needed for rearing Asian seaperch within 224 days

<b>Variables</b>	<b>Output</b>
Amount of feed given within rearing period (g)	4,247
Amount of trash fish given within rearing period (g)	2,769
Amount of pellet given within rearing period (g)	1,479
Initial bodyweight fry (g)	3.7
Market bodyweight of fish (g)	1,091

Total cost of rearing an Asian seaperch was estimated at RM13.09 per tail (Table 5). Production cost in Thailand and Australia is RM7.40 and RM20.30 to RM26.80, respectively, in a small to large scale farm (FAO, 2013). However, the management systems in these countries differ from that practices in Malaysia.

**Table 5:** The cost of rearing an Asian seaperch in cage culture

<b>Variables</b>	<b>Costs (RM)</b>	<b>Total (RM)</b>	<b>Type of cost</b>
Feed cost	11.44	13.09	Operational cost
Trash fish cost	8.40		
Pellet cost	3.05		
Fry price	1.20		
Vibriosis cost	0.385		
Labor cost	0.06		
Maintenance cost	0.78	1.62	Other expenses
Fuel cost	0.84		



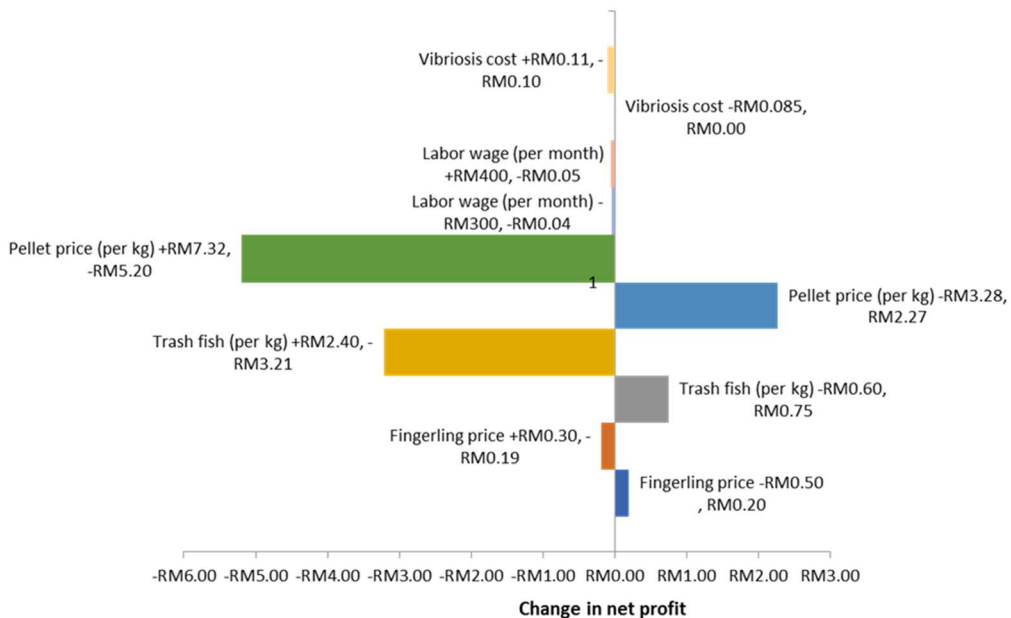
The gross margin of rearing an Asian seaperch to 1,091 g bodyweight per tail was RM3.63. Minus cost of petrol and maintenance, the net profit of rearing an Asian seaperch is estimated at RM2.01 per tail.

Feed cost is the highest cost (87%) of the total operational costs. According to FAO, 2013, feed cost normally ranges between 60 to 80% of total production cost. Based on sensitivity analysis, the cost of rearing Asian seaperch is sensitive to feed costs whereby increases in pellet costs by RM7.32/kg from the default value of RM5.68/kg, resulted in net losses from RM5.20 to RM8.80 per tail. Therefore, farmers need to improve the feed efficiency of the fish for profitable production. This may be done, among others, by feeding twice per day to improve efficiency rate of feed consumption without wastage (Salama, 2008). According to Bunlipatanon *et al.*, (2014), feed costs can be reduced by lowering the trash fish cost but not by lowering the pellet cost.

The deterministic model has several disadvantages because it does not incorporate extreme environmental conditions or disease outbreaks in the estimation. However, there are other models that can be used, including stochastic model, that may produce a wide range of variation in the estimated cost (Rushton, 2009). This study is also hampered by the difficulty in obtaining inputs such as the bodyweight of fish, attribution of feed to bodyweight gain, and by the absence of a standard definition for a fish farm in Malaysia.

## **CONCLUSION**

The total cost of rearing an Asian seaperch in cage culture from 3.7 g (90 days of age) to 1,091 g market bodyweight was RM13.09 per tail. Feed costs contributed 87% to total costs. Farmers should be aware that the cost is sensitive to feed price. Thus, they need to have a more efficient feeding management by increasing the feeding rate and incorporating supplements such as probiotics and vitamins in the feed to improve feeding efficiency which will ultimately reduce production costs.



**Figure 2:** Sensitivity analysis of economic inputs on net profit of rearing an Asian seaperch in cage culture.

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**CLINICAL RESPONSE TO PORCINE REPRODUCTIVE AND  
RESPIRATORY SYNDROME, PORCINE CIRCOVIRUS TYPE 2,  
AND *MYCOPLASMA HYOPNEUMONIAE* 3-IN-1 AND 2-IN-1+1 VACCINES  
IN PIGLETS**

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**ABSTRACT**

Monovalent vaccine is commonly practiced in the swine industry to control diseases in pigs. Manufacturers are merging vaccines together to improve the practicality of vaccination and increase disease protection coverage. However, combined vaccines might have higher interference among vaccine components as the amount of antigen increases. Therefore, the objective of this study was to compare the clinical responses between 3-in-1 vaccine and 2-in-1+1 vaccine against porcine reproductive and respiratory syndrome (PRRS), porcine circovirus type 2 (PCV2) and *Mycoplasma hyopneumoniae* following vaccination of piglets. The hypothesis of the study is there is no significant difference between clinical responses in between vaccination regimens. A total of 160 piglets from 26 pens were divided into control [2-in-1 (PCV2 and *M. hyopneumoniae*), 1-in-1 (PRRS)] and treatment group [3-in-1 (PCV2, *M. hyopneumoniae* and PRRS)]. The piglets were vaccinated at the age of 18 days. The vaccination responses were monitored for 4 weeks post-vaccination. Clinical responses after vaccination, which were rectal temperature changes, adverse inflammatory signs at vaccination site and post-weaning average daily gain (ADG) were compared between the two groups. The results showed no significant ( $p>0.05$ ) difference between groups. There were no adverse inflammatory signs at the vaccination sites in both groups of pigs. This study suggested that piglets vaccinated with the 3-in-1 vaccine did not show statistical ( $p>0.05$ ) difference among treatment groups. However, the single-shot 3-in-1 vaccine is convenience and will reduce labour cost, time, and stress among the piglets during vaccination compared to the 2-in-1+1 vaccine.

**Keywords:** porcine reproductive and respiratory syndrome (PRRS), porcine circovirus type 2 (PCV2), *Mycoplasma hyopneumoniae*, swine, vaccination

## INTRODUCTION

Porcine reproductive and respiratory syndrome, commonly known as PRRS is a widespread disease affecting domestic or feral pigs. Besides Europe and North America, the syndrome has also been identified in China and shown to be present in Japan, Vietnam, the Philippines, Malaysia, and Korea. The disease causes symptoms including reproductive failure, pneumonia and increases susceptibility to secondary bacterial infection. Porcine circovirus are of 2 types, namely porcine circovirus type 1 (PCV1) and PCV2 (Gagnon *et al.*, 2010). Porcine circovirus type 1 is less common, non-pathogen, known to infect pig kidney cell cultures (PK15) and is not linked to any known disease. Porcine circovirus type 2 is associated with post-weaning multisystemic wasting syndrome (PMWS), porcine dermatitis and nephropathy syndrome (PDNS), porcine respiratory disease complex (PRDC), and reproductive diseases (Segales *et al.*, 2012).

*Mycoplasma hyopneumoniae* is the primary agent for enzootic pneumonia. This disease causes retarded growth, poor feed conversion and predisposition animals to bacterial pulmonary infections, leading to economic losses in swine production (Kobisch and Friis, 1996). The high incidence of livestock diseases and co-infections with various pathogens leads to the need of wide disease coverage vaccination. In the swine industry, monovalent vaccines are commonly used but are not as practical because of high labour and cost and time consuming that ultimately increase production cost. Therefore, combined vaccine is preferred because it is practicality and can increase disease protection. However, combined vaccines may be affected by interference among vaccine components that may affect field efficacy and the safety of the vaccine (Tizard, 2013). This study compared the effects of 3-in-1 and 2-in-1+1 in piglets.

## MATERIALS AND METHODS

This study was conducted in a commercial farm in Bidor, Perak, Malaysia. The farm has a swine population of 500 standing sow herd. A total of 160 18-day old piglets, comprising of 80 females and 80 males, were selected from 26 pens and equally divided into control and treatment groups. Animals in the control group were vaccinated with 2 mL 2-in-1 vaccine that comprised of PCV2 and *M. hyopneumoniae* (FLEXcombo®, Boehringer Ingelheim Vetmedica, Inc., U.S.A.) at the left side of the neck via intramuscular route. Simultaneously, the piglets were also vaccinated with 2 mL 1-in-1 vaccine of PRRS (Ingelvac® PRRS MLV, Boehringer Ingelheim Vetmedica, Inc., U.S.A.) on the right side of the neck via intramuscular route. Animals in the treatment group were vaccinated with 2 mL of 3-in-1 combined vaccine of PRRS, PCV2 and *M. hyopneumoniae* (Ingelvac® 3FLEX™, Boehringer Ingelheim Vetmedica, Inc., U.S.A.) as a single shot on the left side of the neck via intramuscular route.

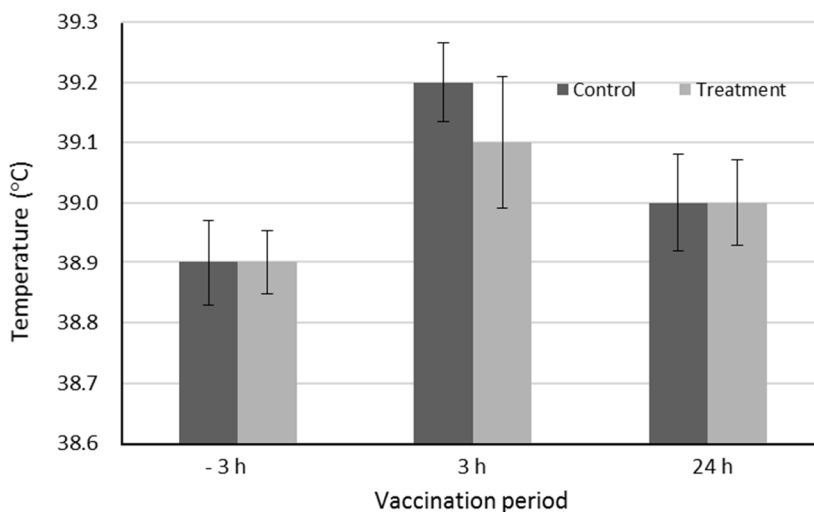
To monitor the rectal temperature, 2 piglets were randomly chosen from each pen of the control and treatment groups. The selected piglets were manually restrained and the rectal temperature were measured with the digital thermometer at three time

points; 3 h before vaccination, 3 h after vaccination, and 24 h after vaccination. The injection sites were examined and appraised visually and palpated to determine reaction to the vaccination. The weaners were weighed at 30 days of age and then subdivided into 40 control male, 40 control female, 40 treatment male and 40 treatment female groups. The weaner was again weighed at 46 days old to determine the post-weaning average daily gain (ADG).

Non-parametric, Mann-Whitney U test was used to compare the rectal temperature and the post-weaning ADG between control and treatment groups. Statistical insignificance was recorded at  $\alpha=0.05$ .

## RESULTS AND DISCUSSION

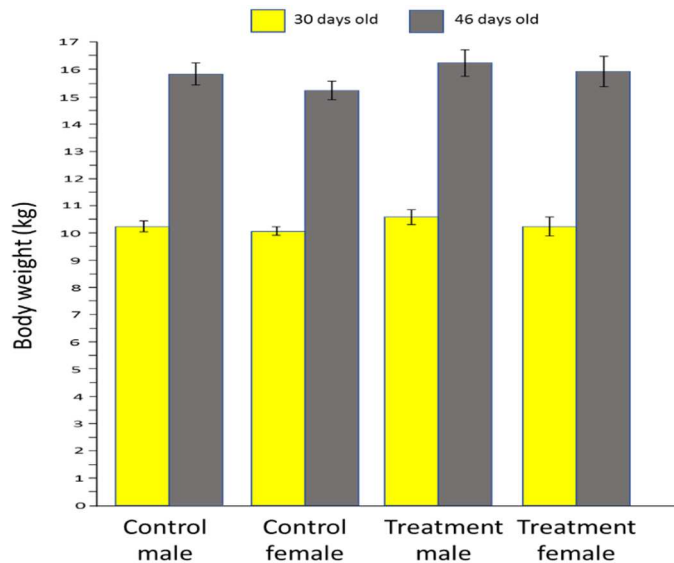
The mean rectal temperature of vaccinated piglets is shown in Figure 1.



**Figure 4.1:** Mean rectal temperature of piglets before and after vaccination with 3-in-1 and 2-in-1 plus 1 vaccines.

Although the mean rectal temperatures appeared to be higher at post- compared to pre-vaccination period, there was no significant ( $p<0.05$ ) difference in mean rectal temperature between group. Despite the fluctuations, the average rectal temperature of both groups remained within the normal range of 38.7 to 39.8°C. This observation is similar to that reported in previous studies (Ensminger and Parker, 1997; Bulay and Penaso, 2014).

The overall ADG of control group and treatment group are 0.34 kg/day and 0.35 kg/day, respectively. Like other studies there is no difference in body weights between the control and treatment groups during the course of the study (Figure 2) (Blood *et al.*, 2011; Bulay and Penaso, 2014).



**Figure 2.** Mean body weights of treated piglets

No obvious inflammatory response was observed at the vaccine site in the piglets. The vaccines are safe systemically tolerated (Piontkowski and Eichmeyer, 2010; Bulay and Penaso, 2014).

## CONCLUSION

This study compared the responses between piglets given 3-in-1 combined vaccine (Ingelvac® 3FLEX™) and 2-in-1 (FLEXcombo®) and 1-in-1 (Ingelvac® PRRS MLV). The study showed rectal temperature and performance did not differ between piglets given these vaccines. The study also showed no inflammatory signs at vaccination site indicating that combined vaccines are safe to be used in piglets.

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## **EFFECT OF RAW EDIBLE BIRDS' NEST ON BOVINE SPERM CRYOPRESERVATION**

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### **ABSTRACT**

In sperm cryopreservation the concentration of reactive oxygen species (ROS) can increase at high concentration ROS can cause oxidative damage to the spermatozoa and decreasing quality of frozen-thawed sperm. Edible Bird's Nest (EBN), consisting of swiftlet saliva secretions have nutritional and anti-oxidative values. The objective of this study was to determine the effect of EBN supplementation on bovine sperm cryopreservation. Eight cattle semen samples from University Agriculture Park, Universiti Putra Malaysia (UPM) were used. The tris-egg yolk extender was used in the diluting and extending process of semen. The samples were then divided into four groups, each supplemented with either 0, 0.25, 0.5, or 1.0 % powdered, raw EBN dissolved in normal saline. All samples were then chilled for 4 h, packed into 0.25 mL straws, frozen, and stored in liquid nitrogen. The frozen-thawed quality of the semen samples was evaluated after 72 h to determine general motility and motility, viability, and abnormalities of the sperm. Although the findings in the study were not statistically significant ( $p>0.05$ ), semen samples supplemented with EBN showed lower degree of morphological abnormalities compared to those not supplemented. Semen supplemented with 0.25% EBN recorded least number of abnormalities. The sperm in this group also showed the highest viability suggesting that EBN has positive cryoprotective effects.

**Keywords:** cryopreservation, sperm, edible bird's nest (EBN), tris-egg yolk

### **INTRODUCTION**

Artificial Insemination (AI) is the most important technique to be used for the improvement of the genetics of farm animals (Murphy *et al.*, 2018). The advancement in the field of AI is mainly attributed to the development of semen cryopreservation protocols that allows for genetic materials from high standard sires to be stored over a longer period and distributed over greater distances. Cryopreservation involves freezing and thawing that are highly deteriorative as shown by the decrease in quality and loss of biological functions of cryopreserved semen (Cámara, *et al.*, 2011).

Reactive oxygen species (ROS) is a product of normal cellular metabolism (Yew *et al.*, 2014). Mammalian sperm membranes are composed of large amounts of

polyunsaturated fatty acids that are susceptible to damage by ROS. In sperm samples, moderate amounts of ROS facilitate the hyperactivation, capacitation, acrosomal reaction, and zona binding of the sperms (Kadirve *et al.*, 2014). Unfortunately, during the freezing and thawing of semen, the concentration of ROS increases to levels that adversely affect viability of sperm.

Edible Bird's Nest (EBN) is a popular Asian delicacy consisting of the salivary secretions of swiftlets. The EBN is claimed to have nutritional and health-promoting benefits. It was shown that EBN increase testosterone and luteinizing hormone levels in the rat uterus and have cryoprotective effects, most probably through its anti-oxidative properties (Albishtue *et al.*, 2018). The objective of this study was to determine the effect of raw EBN supplementation in the cryopreservation bovine semen.

## **MATERIALS AND METHODS**

### *Study design*

Eight semen samples were collected from three mature cross-bred bulls from the University Agriculture Park, Universiti Putra Malaysia (UPM). Two bulls were sampled thrice each, while one was sampled twice, with a rest period of minimum 3 days between sampling. Each sample was divided into 4 groups. Groups A, B, C and D received 0, 0.25, 0.5, and 1.0% (v/v), respectively.

### *Semen collection*

Semen samples were collected using an automated electroejaculator (ElectroJac®6, Neogen Corporation). The prepuce was cleaned by clipping the hair and washing the preputial region. The rectum was thoroughly cleaned of faeces. Transrectal massage was used to stimulate the bull. The probe of the electroejaculator was then inserted into the rectum with the electrodes on the ventral wall. Semen was collected and immediately placed in the 37°C water bath before transportation, with minimal exposure to sunlight, to the Theriogenology and Cytogenetic Laboratory, Faculty of Veterinary Medicine, UPM, for evaluation.

### *Semen evaluation*

The parameters of fresh semen evaluated were volume, colour, wave motion, general and progressive motilities, viability, abnormality, and concentration. The wave motion was evaluated by placing a drop of the fresh semen on a pre-warmed glass slide and observing under the light microscope at 100× magnification. The wave motion was then scored as 0 to 5 for worst to best. General and progressive motilities were determined by first diluting semen in normal saline in a dilution of 1:100. A drop of the diluted semen was placed on a pre-warmed glass slide, covered with a cover slip and observed under 400× magnification. The general motility was estimated by determining the ratio of mobile to non-mobile sperm. The progressive motility was estimated by determining number of sperms showing forward motility (Chenoweth, 2016).

To determine viability and normality, one drop (10  $\mu$ L) of the semen was mixed with 3 drops of eosin-nigrosin stain and left to stand for 2 min. A thin smear of the stained semen suspension was made and examined microscopically under 400 $\times$  magnification. The head of live sperm was white while dead sperm was pink.

The concentration of the semen was determined by further diluting the sample in formal saline (formaldehyde + NaCl). This is done by mixing 100  $\mu$ L of the sample in 900  $\mu$ L normal saline. The concentration of the sample is the calculated by counting the number of sperms using a hemocytometer.

#### *Sperm cryopreservation*

Raw EBN stock solution was made by dissolving 1 g of raw EBN powder in 100 mL normal saline. Tris buffer solution was prepared by dissolving 2.42 g Tris (hydroxymethyl aminomethane), 1.48 g citric acid, and 1 g fructose in 100 mL double distilled water and stored in the fridge until use. One day before performance of cryopreservation, 30 mg Penicillin and 100 mg Streptomycin was added to the 100 mL Tris buffer solution. Then, 20 mL of egg yolk in 80 mL buffer was divided into 2 equal parts. Part A was extender A. 6.4 mL glycerol was added to 43.6 mL Part B suspension (extender B). Extending procedure of the fresh sample was carried out after the evaluation was done using the two-step method (Peña and Linde-Forsberg, 2000). The extended sample was then equilibrated at 4°C for 4 h, packed into 0.25 mL straws, vapor-frozen for 12 min before plunging into liquid nitrogen. The post-thawed evaluation was carried out 72 h later.

## RESULTS AND DISCUSSION

**Table 1:** The quality of bull semen with different percentages of EBN supplemented

Sperm characteristic	Edible bird's nest supplement (%)				
	Fresh sample	0	0.25	0.5	1.0
General motility	72.5 $\pm$ 3.1	35.31 $\pm$ 2.34	30.63 $\pm$ 2.1	32.81 $\pm$ 2.24	32.81 $\pm$ 3.11
Progressive motility	61.9 $\pm$ 3.7	20.19 $\pm$ 2.44	17.5 $\pm$ 2.22	22.31 $\pm$ 2.77	20.31 $\pm$ 3.42
Vitality	78.3 $\pm$ 4.1	56.41 $\pm$ 3.52	57.33 $\pm$ 3.82	52.81 $\pm$ 2.85	52.13 $\pm$ 1.49
Abnormality	10.3 $\pm$ 1.6	25.00 $\pm$ 1.64	19.00 $\pm$ 1.28	20.37 $\pm$ 1.55	21.25 $\pm$ 1.70

The quality of the fresh sperm sample was better than those in extender supplemented with EBN (Table 1). There no difference in sperm characteristics among samples in extenders with different concentrations of EBN. However, the viability of sperm in extender with 0.25% showed the lowest sperm abnormality among extended semen. This is an indication that 0.25% EBN supplementation is the best for the cryopreservation of bovine semen.

## CONCLUSION

There was noticeable improvement in the post-thawed semen quality in extenders supplemented with 0.25% EBN over semen in non-supplemented extender. This suggests that supplementation of extender with EBN may potentially be good for the maintenance of quality of cryopreserved semen.

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## **DETECTION OF GASTROINTESTINAL PARASITES AND HAEMOPARASITES OF HORSES IN VARIOUS EQUINE ESTABLISHMENTS IN SELANGOR, MALAYSIA**

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### **ABSTRACT**

Horses are susceptible to intestinal and blood parasite infestations. Currently, the prevalence of parasite infestations in horses in Malaysia is not clear. Thus, the primary aim of this study was to determine the presence of gastrointestinal and blood parasites in horses in Selangor, Malaysia. A total of 62 horse blood and fresh faecal samples were obtained from various equine establishments, taking into consideration their age, sex, breed, and deworming status. The presence of haemoparasites was determined on Giemsa-stained thin blood smear and on hematocrit samples. The McMaster faecal egg count and faecal culture were performed on fresh samples for detection of gastrointestinal parasites. The results showed, overall, gastrointestinal parasites were detected in 26% of the samples. There was no significant ( $p>0.05$ ) difference in prevalence of gastrointestinal parasites among horses of different age, sex, and breed. Identification of third stage larvae showed *Trichonema* sp. and *Trichostrongylus* sp. was present in 94% and 6% of cases, respectively. None of the horses were positive for haemoparasite.

**Keywords:** gastrointestinal parasites, haemoparasites, Giemsa stain, thin blood smear, McMaster

### **INTRODUCTION**

Horses are susceptible to gastrointestinal parasites and the most common parasite found in horses include small and large *Strongyle* spp., *Ascarids* (*Parascaris equorum*), pin worms (*Oxyuris equi*), and tape worms (*Anocephala* spp.). According to Tesfu *et al.* (2014), helminth infestation causes gastrointestinal tract inflammation. Among clinical findings in horses infected with these helminths are low-grade fever, poor appetite, intermittent colic, poor weight gain, poor coat and diarrhoea. Among blood parasites that commonly infest horses are the *Trypanosoma* sp., *Babesia* sp., and *Theileria* sp. Horse infested with *Trypanosoma evansi* show clinical signs including intermittent fever, anaemia, weight loss, and death.

In Malaysia, the first clinical report of acute piroplasmiasis in horses was in Kelantan (Al-Obaidi *et al.*, 2016), which was due to *Theileria equi* and *Babesia caballi*. Another comprehensive investigation in eight states showed that *T. evansi* is prevalent parasite (Elshafie *et al.*, 2013), although *Babesia* spp. and *Theileria* spp. were also shown to be present (Obaidi *et al.*, 2015).

This study determined the occurrence of gastrointestinal and blood parasites in horses in Selangor, Malaysia.

## **MATERIALS AND METHODS**

Faecal and blood samples were obtained from 62 horses kept in stable in various establishments in Selangor. The faecal sample were processed using the modified McMaster faecal egg count and faecal culture. Four grams of fresh faecal sample were mixed with 60 mL saturated NaCl and thoroughly mixed. The mixture was then filtered using the tea sieve and the filtrate mixed well by stirring. The helminths ova were counted under 10× objective compound microscope. Ten grams of faecal sample positive for helminth ova was mixed with distilled water in a bottle to obtain a moist culture mixture and culture covered with a moist gauze. The culture was left to stand for a week at room temperature. The larvae were harvested using Baermann procedure (Foreyt, 1989). After removing the gauze, lukewarm water was added to the culture to form a meniscus on the surface. A petri dish was placed on the meniscus and carefully inverted together with the bottle. Lukewarm water was poured on the petri dish to obtain the larvae. After 30 minutes, water containing larvae was transferred to a centrifuge tube and left to stand for a few minutes to sediment. The supernatant was discarded and a drop of Lugol's iodine was added to the tube. The sediment was examined under compound microscopy for identification of larvae species.

Giemsa-stained thin blood smear was examined microscopically for blood parasites under oil immersion objective. A minimum of 10,000 red blood cells was examined on each slide to determine the presence of parasites.

The capillary tube filled with whole blood was centrifuged in a microhemacrit centrifuge for 5 min. The capillary tube was snapped and a drop of buffy coat placed a clean slide, covered with cover slip and examined microscopically.

### *Statistics*

The data were analyzed using the Chi-Square analytical method to compare association between data.

## **RESULTS AND DISCUSSION**

Horses from six establishments were positive for strongyle with a 26% detection rate. The most likely reason for the low detection rate is good management practice, where the manure was frequently removed the stables. In addition, all establishments

frequently use the anthelmintic, oxfendazole and Abamectin to contain parasitic infestation.

Among risk factors associated with gastrointestinal parasitism in horses are age, sex, and breed. In our study this no significant association between age and gastrointestinal parasitism in the horses although older horses develop immunity towards parasites. The sample size in our study was small, and the horses were mostly adults, which could have contributed to the insignificant findings.

Male horses (27%) were shown to be slightly more frequently affected by the gastrointestinal parasites than females (24%). The study also showed mares seemed to be more prone to gastrointestinal parasitism than stallion or gelding.

Based on breed, the Criollos showed the highest frequency of gastrointestinal parasitism at 45%. Polo Pony and Warmblood breed showed similar lowest infestation rate at 20%. No gastrointestinal parasites were detected in Thoroughbred horses.

The study failed to show presence of haemoparasites in the horses sampled from the establishments in Selangor. The stables in these established do not practice of open grazing system and there is no livestock in the vicinity that could provide source of vectors for the parasite. The stables were well-managed and the horses healthy. Although our horses were negative for haemoparasites, this finding is not representative of the state of haemoparasitism in the country. In fact, in Negeri Sembilan, Malaysia, where horses were allowed to graze along with buffaloes and cattle, the prevalence of haemoparasites was approximately 13% (Al-Obaidi *et al.*, 2015). Thus, the detection rate of haemoparasites in horses reflects the management practices and climatic conditions of the region.

## CONCLUSION

This research work showed that 26% of horses were positive for gastrointestinal parasites. The species of larva with the highest identification rate was *Trichonema sp.* at 94%. There is no significant association between parasitism and age, sex, and breed of horses.

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**RETROSPECTIVE STUDY ON PORCINE REPRODUCTIVE AND  
RESPIRATORY SYNDROME SEROLOGY STATUS AMONG  
BLOOD SAMPLES SUBMITTED TO THE FACULTY OF  
VETERINARY MEDICINE, UNIVERSITI PUTRA MALAYSIA  
BETWEEN 2016 AND 2017**

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**ABSTRACT**

Porcine reproductive and respiratory syndrome (PRRS) is an economically important viral disease. This study aimed to determine the PRRS serological status of blood samples submitted Faculty of Veterinary Medicine, Universiti Putra Malaysia for diagnosis between year 2016 and 2017. Fifty-eight farms located in the Northern, Central, and Southern regions of Malaysia provide 2,940 blood samples used in this study. The farms had vaccinated and unvaccinated, growing and breeding gilts and sows, aged 4 to 21 weeks. Blood analyses were done using the IDEXX HerdChek<sup>®</sup> PRRS X3 anti-PRRSv antibody ELISA test kit and results were interpreted using the IDEXX xChek Plus<sup>®</sup> software. A PRRS status classification system based on both sample-to-positive ratios (S/P) and coefficient of variation (CV%) of the ELISA results was devised and used in the study. All blood samples from all farms were seropositive for PRRS a seroprevalence of 99.8%. Weaners aged 4 to 8 weeks, especially showed variable seronegativity among blood samples from the various farms. The study did not reveal any definitive pattern in distribution of PRRS status across regions of Malaysia. Vaccinated herds showed better PRRS seropositivity than the non-vaccinated. A large proportion of weaners aged 4 to 8 weeks and gilts were poor in PRRS seropositivity. The farms status classification system proposed in paper can distinguish good from moderate growing and moderate from poor breeding herds.

**Keywords:** porcine reproductive and respiratory syndrome (PRRS), ELISA, sample-to-positive (S/P) ratio, coefficient of variation (CV%), serological status, PRRS status, PRRS seroprevalence, Malaysian swine farms

## INTRODUCTION

Porcine reproductive and respiratory syndrome (PRRS) was first reported in United States of America in 1987 and in Europe in 1990 (Albina, 1997), while its causative agent, PRRS virus (PRRSv), was identified in 1991 (Benfield *et al.*, 1992). PRRSv is placed under the order Nidovirales, family Arteriviridae, genus Arterivirus. Pigs (*Sus scrofa*), both domestic and feral, is the only species known to be naturally susceptible to PRRSv (Dokland, 2010). As its name implies, the clinical features of PRRS manifest as reproductive failures in sows and respiratory diseases in young pigs. More than a quarter of century after its emergence, PRRS is still considered as one of the costliest diseases to the swine industry worldwide, causing substantial economic losses in acute epidemic cases and decreased revenues in endemic situation. This study was conducted to determine the PRRS serological status among blood samples from farms, submitted Faculty of Veterinary Medicine (FPV), Universiti Putra Malaysia (UPM) between year 2016 and 2017. The PRRS status classification system suggested in this study attempts to identify Malaysian farms as good, moderate or poor farm by the means of interpretation of sample-to-positive (S/P) ratio and coefficient of variances (CV%) of enzyme-linked immunosorbent assay (ELISA) results. The study determined the PRRS status in several regions of Peninsular Malaysia, growing and breeding herds, pigs of various ages, gilts, sows, and vaccinated and unvaccinated herds.

## MATERIALS AND METHODS

A total of 2895 porcine blood samples collected from 57 swine farms in Peninsular Malaysia submitted to FPV, UPM for PRRS diagnosis were used in the study. The blood samples were analysed using the IDEXX HerdChek<sup>®</sup> PRRS X3 PRRSv antibody ELISA test (IDEXX Laboratories Inc., Maine, USA) and data analysed using the IDEXX xChek Plus<sup>®</sup> software (IDEXX Laboratories Inc., Maine, USA). The data were grouped according to their geographical locations, i.e., Northern, Central and Southern region of Malaysia, production stage (growing and breeding herd), age (weaners: 4 – 8, growers: 9 – 12 and 13 – 16, finishers: 17 – 21 weeks old, and gilts and sows).

The production stages were classified as ‘good’, ‘moderate’ and ‘poor’ based on their S/P ratio and CV% value [Erickson, 1995; Ooi and Dorado (personal communication, 2018)] (Table 1).

A herd must pass both the S/P ratio and CV% aspects to obtain a ‘good’ status. If only one aspect is passed, the of status of the herd was classed as moderate. A herd would be poor if it fails both aspects. An overall PRRS status for a farm was then obtained by averaging the PRRS status for growing and breeding herd.

An ideal S/P ratio, 0.4 to 2.4 for growing herd; 1.8 to 2.2 for breeding herd, could suggest stable yet sufficient levels of circulating anti-PRRSv antibodies. Below range S/P ratio values could suggest an ongoing vaccine-induced adaptive immunity, or a lack of PRRSv exposure in a PRRS negative farming environment. PRRS viremia and acute infection would be suspect when S/P ratio of > 2.5 and 3.5 to 5.0

respectively (Ooi and Dorado, personal communication, 2018). An ideal CV% of <40% for growing herd and <30% for breeding herd, indicates uniformity of antibody levels among individuals within a herd, which could in turn suggest good response to herd vaccination or blanket infection.

**Table 1:** Herd PRRS status classification system based on sample-to-positive (S/P) ratio and coefficient variance (CV) values from PRRS ELISA interpretation

Growing Herd			Breeding Herd		
S/P Ratio	CV (%)	Status	S/P Ratio	CV (%)	Status
0.4 - 2.4	< 40.0	Good	1.8 - 2.2	< 30.0	Good
< 0.4, or > 2.4	< 40.0	Moderate	< 1.8, or > 2.2	< 30.0	Moderate
0.4 - 2.4	> 40.0	Moderate	1.8 - 2.2	> 30.0	Moderate
< 0.4, or > 2.4	> 40.0	Poor	< 1.8, or > 2.2	> 30.0	Poor

Differences in farm PRRS status as a singular entity, and S/P ratio and CV% separately was analysed statistically, and significance was recorded at  $\alpha=0.05$ .

## RESULTS AND DISCUSSION

All farms were seropositive with seroprevalence of 99.8%. Seronegativity was mainly observed in weaners aged 4 to 8 weeks. High seropositivity was observed in the breeding herds of five seropositive farms.

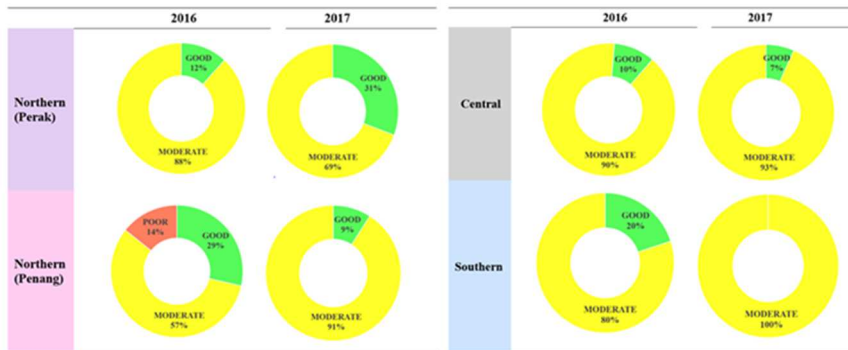
Despite the observed gross difference in number of good farms, there was no significance across regions of Malaysia. More breeding herds and weaners of 4 to 8 weeks of age, gilts and sows were classified as poor. In the growing and breeding herds, vaccinated showed better PRRS status than non-vaccinated herds.

The high seronegativity (24 to 27%) in weaners aged 4 to 8 weeks may be due to the short duration between vaccination and sampling or to usage of killed vaccines. Killed vaccines do not cause production of ELISA nor serum neutralization detectable antibodies (Dotti *et al.*, 2011).

Farms in the Perak, a Northern region of Malaysia, practiced vaccination in 2017; thus, that year, the proportion of good farms was higher than in other regions (Figure 1). Only a few farms in the central region were good in 2017. This finding may be attributed to the outbreak of foot and mouth disease that year that had disrupted the farm vaccination regimens.

### *Variation across regions of Malaysia*

Mass vaccination usually involves growing herds of similar farrowing batch and the whole breeding herds, thus, more likely to confer uniform and stable levels of anti-PRRSv antibodies. The central and Northern regions showed the lowest proportion of herd in the good category.



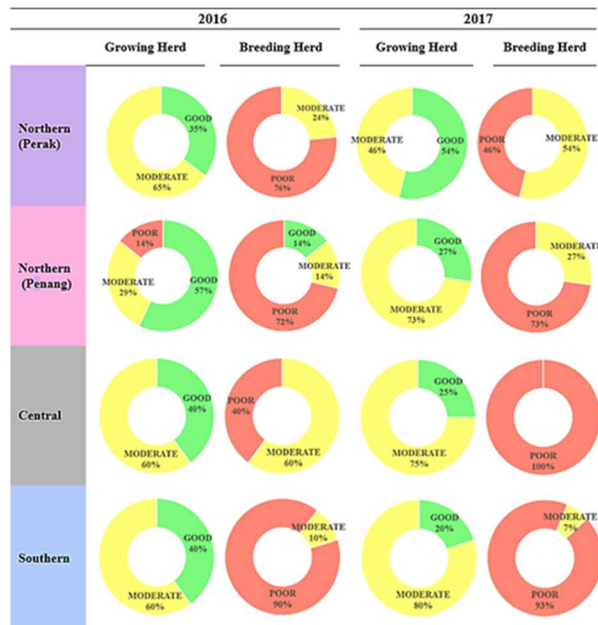
**Figure 1:** Farm porcine reproductive and respiratory status across regions of Malaysia based on blood samples submitted to the Faculty of Veterinary Medicine, Universiti Putra Malaysia in 2016 and 2017.

*Validity of classification system*

The classification based on S/P ratio and CV% values is valid and allowed for the grouping of the growing and breeding herds herd into good, moderate, and poor.

*Variation among growing and breeding herds*

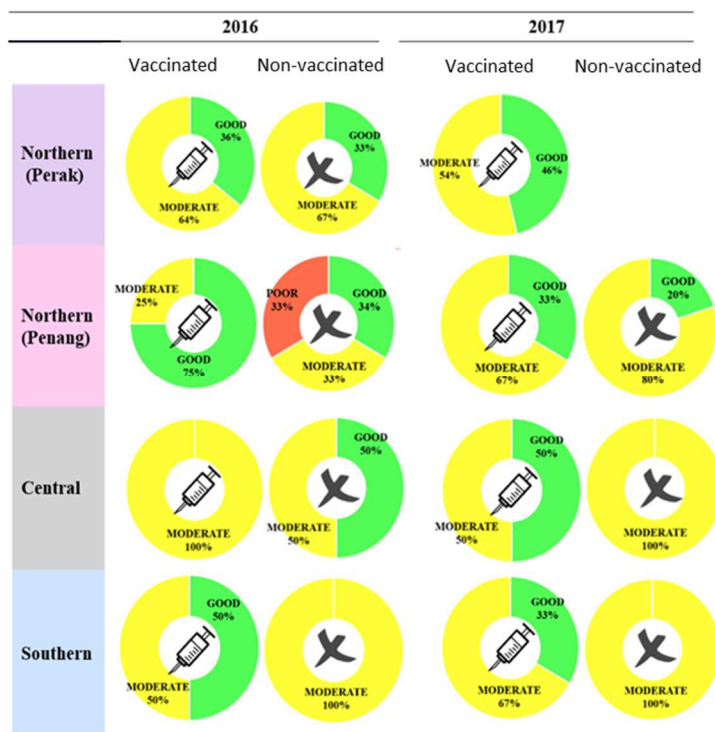
In all regions of Malaysia there was a greater proportion growing herd that were good in 2016 than in 2017 (Figure 2). However, there were very few breeding herds that were good in the two-year study period.



**Figure 2:** Herd porcine reproductive and respiratory syndrome status in growing and breeding herds across regions of Malaysia based on blood samples submitted to Faculty of Veterinary Medicine, Universiti Putra Malaysia in 2016 and 2017.

### Variation between vaccinated and unvaccinated herds

In 2016, the proportion of good herd among vaccinated pigs in the Central and in the non-vaccinated pigs in the Southern region (Figure 3). However, in 2017, only non-vaccinated herd in these regions that was not in the good group. Although there is variability, vaccinated were generally grade better than the non-vaccinated herds.



**Figure 3:** Herd porcine reproductive and respiratory syndrome status among vaccinated and unvaccinated growing herds across regions based on blood samples submitted to Faculty of Veterinary Medicine, Universiti Putra Malaysia in 2016 and 2017.

## CONCLUSION

Among the blood samples submitted to FPV, UPM in 2016 and 2017, the PRRS status varied among growing and breeding herds and across age groups. Generally vaccinated herds had better PRRS seropositivity than non-vaccinated herd.

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## **FACTORS AFFECTING DRINKING WATER VACCINATION INTAKE IN COMMERCIAL POULTRY FARMS**

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### **ABSTRACT**

Vaccines are important means of prevention and control of poultry diseases. Drinking water vaccination remains as one of the most common mass vaccine administration methods. The efficiency of this mode of vaccination relies rate of consumption of vaccinated water by the chickens. This study aims to determine the success rate of and factors affecting drinking water vaccination in commercial poultry farms in Malaysia. Five poultry farms that practice drinking water vaccination were selected for study. Two houses (first and last house) of each farm were evaluated. Prior to vaccination, blue dyes (Cevamune®) were added in the drinking water tank and farm parameters were recorded. Between 100 to 250 chickens (1% of house population) were randomly sampled at 2 h post-vaccination and evaluated for vaccine intake based on the blue dye stain in their mouth. From the study, only 10% of the houses fulfilled the requirement of yielding a minimum of 90% positive vaccine intake. The study further revealed that the ambient temperature, water restriction hours prior to vaccination stocking density, age of chick, and effort of workers to chase chicks during vaccination, have significantly ( $p > 0.01$ ) affected the outcome of drinking water vaccination. Appropriate steps are required to mitigate such risks factors to maximise efficacy of this administration method. Existing practice of drinking water vaccine delivery should also be revised to improve the outcome of drinking water vaccination method.

**Keywords:** commercial poultry farms, drinking water vaccination, ambient temperature, water restriction hours, stocking density

### **INTRODUCTION**

Poultry is an important source of animal protein and remains as one of the most popular meat sources throughout the world. Different poultry production systems, ranging from backyard to intensive system are practices to meet the increasing demand for animal proteins (Marangon and Busani, 2006). Among factors that play

vital roles in the continuous production and health of poultry are flock health programme biosecurity, supplement, medical treatment, and vaccination.

Vaccination accounts for one of highest costs in poultry production. However, vaccination is essential in the prevention and control of diseases and improvement of production (Bell et al., 2002). Vaccines can be delivered via various methods. Among these methods, drinking water vaccination remains as one of the easiest, quickest, and most commonly used in mass vaccine administrations. The method is not labour-intensive and requires minimal handling of chicks (Bernardi and Johnson, 2011). However, cases of uneven coverage, outbreaks of diseases, especially infectious laryngotracheitis can occur (Menendez et al., 2014). Vaccination failure is sometimes subtle and the efficiency of vaccination makes the difference between success and failure of the poultry business (Saif, 2008).

Drinking water vaccination efficiency relies on the vaccinated water consumption by the chicks. To ensure efficacy of this vaccination method, factors contributing to the inefficiency of water vaccine intake in a flock need to be addressed and mitigated (Abdul-Careem, 2015). This study determined factors affecting drinking water vaccination intake in commercial poultry farms in Malaysia.

## **MATERIALS AND METHODS**

Five poultry farms were selected for this study. Two houses (first and last house) from each farm were evaluated in the study. Chlorine, a neutralizing agent and blue tracer, was added in the drinking water tank prior to vaccination with Cevamune® (Ceva Santé Animale, France). Farm parameters recorded included ambient temperature, water restriction hours, stocking density, water volume used for vaccination, and age of chicks. The chickens were vaccinated according to the farm routine vaccination practices. At 2 h post-vaccination, 100 to 250 chickens (1% of house population) were randomly sampled and evaluated for vaccine intake based on the blue dye stain in their mouth.

## **RESULTS AND DISCUSSION**

A successful drinking water vaccination practice is defined by 90% of birds in flock having well-stained crops and tongues (Fernandez, 2008). Among the ten poultry houses selected, only one achieved vaccination success at 97.11%. The remaining houses scored below 90% with the lowest at 39.80%. This study shows that drinking water vaccine delivery in Malaysia need to be improved to ensure high vaccination efficiency.


### *Ambient temperature*

Ambient temperature serves as one of the most important factors affecting water consumption (Vermeulen et al., 2002). As the ambient temperature increased, percentage of vaccinated chicks increased significantly ( $p < 0.01$ ), especially in bands



6 and 7. With increase in ambient temperature, the water intake increases resulting in better vaccine intake (Table 1).

**Table 1.** Vaccine uptake score according to ambient temperature.


<b>Ambient Temperature (°C)</b>							
	<b>24.80</b>						<b>34.87</b>
<b>Band</b>	1	2	3	4	5	6	7
<b>Score (%)</b>	55.20 <sup>a</sup>	59.80 <sup>a</sup>	61.20 <sup>a</sup>	65.50 <sup>a</sup>	66.10 <sup>a</sup>	97.10 <sup>b</sup>	89.30 <sup>b</sup>

*a, b : Values within row with different superscripts differ significantly at 95% confidence level ( $p < 0.01$ ).*

#### *Water restriction*

Drinking water vaccination practices in the farm involves water restriction for flock to eliminate water intake by the chicks and causing them to develop mild thirst (Saif, 2008) (Table 2). With increase in duration of water restriction, the percentage of chicks being vaccinated increased. This is particularly observed in bands 6 and 7 that is from 250 to 280 min of water restriction. However, traumatic injuries to the poultry occurred with 280 min of water restriction. Therefore, the duration of water restriction duration must be optimised to ensure that it does not cause excessive stress and injuries to the flock.

**Table 2.** Water Restriction Duration Scoring Table


<b>Water Restriction Duration (mins)</b>							
	<b>47</b>						<b>280</b>
<b>Band</b>	1	2	3	4	5	6	7
<b>Score (%)</b>	59.80 <sup>a</sup>	55.20 <sup>a</sup>	61.20 <sup>a</sup>	65.50 <sup>a</sup>	66.10 <sup>a</sup>	89.30 <sup>b</sup>	97.10 <sup>b</sup>

*a, b : Values within row with different superscripts differ significantly at 95% confidence level ( $p < 0.01$ ).*

#### *Stocking density*

Stocking density is an important factor in poultry production. High stocking density would result in high environmental temperature in the houses (Table 3). The consequence is reduction in airflow at flock level and the chicks loses ability to dissipate body heat (Feddes et al., 2002). Chicks under heat stress compensate by increasing water intake (Keeling and Hurnik, 1996).

**Table 3.** Stocking density and vaccination scores in chicks

<b>Stocking Density (ft<sup>2</sup>)</b>					
	<b>0.45</b>				<b>0.70</b>
<b>Band</b>	1	2	3	4	5
<b>Score (%)</b>	97.10 <sup>a</sup>	89.30 <sup>a</sup>	65.90 <sup>a</sup>	59.80 <sup>b</sup>	58.40 <sup>b</sup>

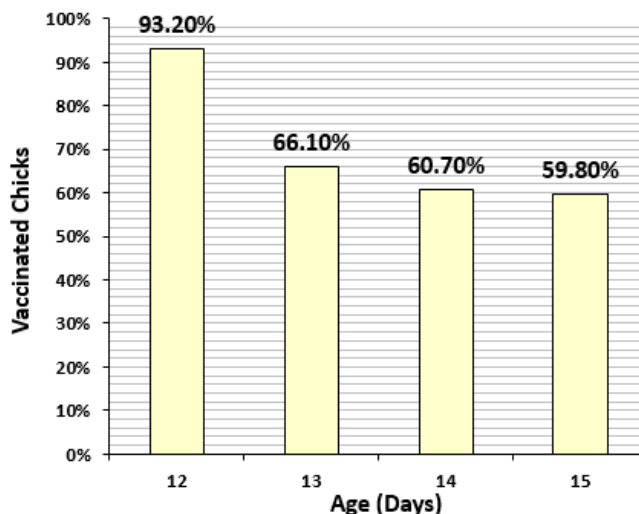
*a, b* : Values within row with different superscripts differ significantly at 95% confidence level ( $p < 0.01$ ).

#### *Water volume*

The exact water volume required for vaccination can be calculated using available guidelines (Fernandez, 2008). However, our study showed the volume of water used by farmers exceeded the recommended value. The lack of awareness on the importance of providing accurate water volume compromised rate of vaccine uptake by the chicks.

#### *Age of chicks*

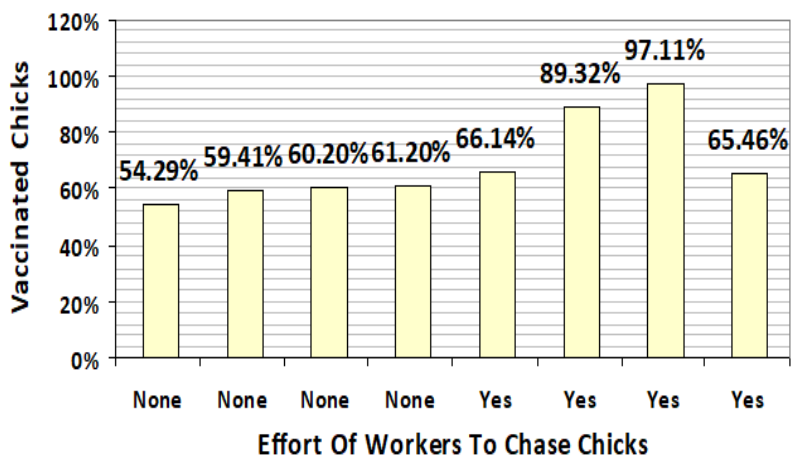
The percentage of vaccinated young chicks was high (Figure 1). Young chicks are smaller than older chicks. For instance, a 10-day-old chick would weigh 280g, compare to 460g in the 4-day-olds (Cobb500™, 2015). Young chicks being smaller, occupy less space, allowing for more young chicks per drinker than the large older chicks.



**Figure 1.** Percentage of vaccinated chicks according to age.

### *Effort of workers to chase chicks*

Among the houses selected for the study, four, because of the effort of the workers in chasing and capturing chicks, showed high percentages of vaccinated chicks, ranging from 65.46 to 97.11% (Figure 2). The movement of workers in the chick houses also caused the bird to move towards the drinkers increasing the probability of chicks drinking water. By checking the drinkers, the workers also took immediate corrective measures on clogged bell drinkers and nipple drinker lines.



**Figure 2.** Relationship between effort of workers chasing chicks and percentage of vaccinated chicks

## CONCLUSION

Successful drinking water vaccination is highly dependent on multiple factors, namely ambient temperature, water restriction duration prior to vaccination, stocking density, age of chicks and effort of workers to chase chicks. These factors should be optimized to ensure a successful vaccination programme in a poultry farm.

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## **A RETROSPECTIVE STUDY ON KIDNEY DISEASE-ASSOCIATED ANAEMIA IN CATS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL, UNIVERSITI PUTRA MALAYSIA**

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### **ABSTRACT**

The kidneys play an important role in the clearance of toxic substances from the body and maintenance of health. The organs also maintain a constant extracellular environment for the maintenance of effective metabolic processes. Kidney diseases can either be acute kidney injury (AKI) or chronic kidney disease (CKD). Patients with chronic kidney disease have greater tendency to develop anaemia than those with acute kidney injury. The objective of this retrospective study was to determine and compare the frequency and risk of development of anemia in suspected AKI and CKD cases in cats. The study uses the IRIS staging standards to stage CKD in these cats. Records on feline kidney disease cases for year 2017 were obtained from the Veterinary Haematology and Clinical Biochemistry Laboratory, Faculty of Veterinary Medicine, Universiti Putra Malaysia. The study showed that in 2017 there was a higher frequency of anaemia in CKD than AKI cat patients. The data also showed that cats in stage 3 CKD were not at risk of developing anaemia. However, cat patients in stage 4 CKD were 18 times more at risk of developing anaemia than those in stage 1 or 2. In conclusion, cats in stage 4 of CKD have higher frequency and risk of developing anaemia.

**Keywords:** chronic kidney disease, acute kidney injury, anemia, IRIS staging

### **INTRODUCTION**

The kidneys play an important role in homeostasis. Any dysfunction of the renal system will disrupt clearance of waste products from blood and lead to the development of azotaemia, a condition caused by accumulation of nitrogenous compounds in blood.

Erythropoietin is a hormone that is produced by the kidneys to regulate the erythrocyte number in blood. The hormone is essential for the stimulation of erythrocyte production by the bone marrow. Therefore, kidney damage affects the production of erythropoietin and reduces erythrocyte production, leading to

development of anaemia. Although, kidney disease is one of the main causes of anaemia, there are other factors that can lead to the condition.

Kidney diseases are one of the most common diagnosed ailments in small animal practices. The incidence chronic kidney disease (CKD) in cats is 2 to 3 times higher than in dogs. The disease is especially common in geriatric cats (Houston, 2016). A study at the University of Minnesota Veterinary Medical Center showed that more than 10% of dogs and 30% of cats over 15 years of age were diagnosed with CKD (Bartges, 2012).

This study was conducted to compare the incidence of acute kidney injury (AKI) and CKD, frequency of anaemia in AKI and CKD, and to determine the risk of developing anaemia in cats with CKD.

## **MATERIALS AND METHODS**

### *Study method*

The retrospective study was conducted by obtaining records of feline kidney disease cases, for the year 2017, from the Veterinary Haematology and Clinical Biochemistry Laboratory, Faculty of Veterinary Medicine, Universiti Putra Malaysia. Information extracted included history and tentative diagnosis, complete blood count, serum sodium, potassium, chloride, phosphate, urea and creatinine, urine specific gravity, protein concentration, and urine protein-to-creatinine ratio values. The data were differentiated into AKD and CKD cases, based on laboratory analytical results, history, physical examination and tentative diagnosis, and age groups. The CKD cases were further sub-staged using the IRIS staging system (Elliot and Watson, 2016), which is based on serum creatinine concentration. Parameters such as proteinuria and blood pressure were taken into consideration for the sub-staging. The incidence of AKI and CKD as well as the frequency of anaemia in AKD and CKD in cats were compared.

### *Data analysis*

Data was analysed using the IBM SPSS software to determine the odds ratio between the development of anaemia and stage of CKD. The categorical data obtained were analysed by cross-tabulation. The significance of results was determined at  $\alpha=0.05$ .

## **RESULTS AND DISCUSSION**

In year 2017, there were a total of 175 cases of kidney disease in cats presented to University Veterinary Hospital, UPM. Among these cases, 57% (n=99) were patients with CKD and 43% (n=76) with AKI. It was found that 64.5% (n=60) of CKD patients were geriatrics (ages  $\geq 8$  years) and 53.7% (n=36) of AKI patients were 5 years old or younger. There was an age predisposition for CKD patients. Out of 66 AKI cases, 31.8% (n=21) suffered from anaemia while in CKD cases, 42.3% (n=33) suffered from the same condition. The study showed that CKD patients were at 1.57 times more risk of developing anaemia than AKI patients. Based on the odd ratios,

all cat patients in stage 3 CKD had similar risks of developing anaemia while patients in stage 4 CKD were 18 times more likely to develop anaemia than those in stages 1 and 2.

## **CONCLUSION**

Cats presented to UVH in the year 2017 showed higher incidence of CKD than AKI. Most of the patients with CKD are geriatrics. However, the risk of developing anaemia between AKI and CKD patients was similar. In addition, cat patients in stage 4 CKD had higher risk of developing anaemia compared to the other stages of the disease.

Further studies using the plasma symmetric dimethylarginine (SDMA) concentration method is warranted as SDMA is an early biomarker of change in glomerular filtration rate (GFR) and renal disease.

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## **EFFECT OF TEMPERATURE ON THE EXPOSURE OF AMMONIA IN JUVENILE HYBRID GROUPE**

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### **ABSTRACT**

Ammonia that can be in either in unionized or ionized aqueous form is toxic to all vertebrae including fish and a major concern in aquaculture industry. The proportion of unionized and ionized ammonia in the water depends on the temperature and pH of the water. In Malaysia, the temperature changes throughout the year. Therefore, the objective of this study is to determine the effect of temperature on the exposure of ammonia in the juvenile hybrid grouper. Eighty juvenile hybrid grouper weighing about 28.3 g with total length of 11.9 cm were used to assess their capabilities to respond towards ammonia level and different temperature. All fish were divided into 8 groups; Group A1 (1.5mg/L NH<sub>3</sub>-N at 29°C), Group A2 (2.5mg/L NH<sub>3</sub>-N at 29°C), Group A3 (3.5mg/L NH<sub>3</sub>-N at 29°C), Group B1 (1.5mg/L NH<sub>3</sub>-N at 25°C), Group B2 (2.5mg/L NH<sub>3</sub>-N at 25°C), Group B3 (3.5mg/L NH<sub>3</sub>-N at 25°C). The negative control group was maintained at 25°C and 29°C without ammonia. The results showed that the amount of total ammonia increased and the proportion of the unionized ammonia decreased with time in all treatment groups. In addition, no mortality was observed in in the 25 and 29°C groups maintained under various levels of ammonia. This suggests that fish has ability to respond and tolerate elevated ammonia in the water. Moreover, the fish has the ability to convert ammonia to innocuous substances, such as glutamine and urea. In conclusion, the study showed that metabolism of juvenile hybrid grouper allow for the fish to tolerate elevated ammonia level in the water.

**Keywords:** temperature, ammonia, hybrid grouper



## EVALUATION OF BUFFALO (*BUBALUS BUBALIS*) MILK QUALITY FROM FARMS IN KEDAH, MALAYSIA

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### ABSTRACT

Buffalo milk possesses significant advantages and has high potential to be developed as a source of protein for Malaysian. Quality evaluation of the buffalo milk is poorly practiced in Malaysia. This study was aimed to evaluate the quality of buffalo milk produced from farms in Kedah. Raw milk samples were randomly collected from five Murrah buffalo farms managed under integrated semi-intensive system, located in Kuala Ketil, Kulim, and Pendang, Kedah, Malaysia. Five selected parameters were used in determination of the buffalo milk quality based on milk stability, keeping quality, composition, antimicrobial residue, and sanitary and hygienic status. Analysis of milk stability and keeping quality was determined through alcohol test and methylene blue reduction test (MBRT), respectively. Analysis of the buffalo milk composition such as fat, protein, lactose, total solids and solid non-fat were carried out using the Lactoscan Milk Analyzer calibrated for buffalo milk. Determination of antimicrobial residue were done using the Delvo Test Kit technique. The hygiene status of the milk was determined by enumerating microbes using the total plate count. The alcohol test and MBRT showed negative results, indicating good milk stability and keeping quality. The analysis of the chemical components as well as composition of the milk showed the results of fat, protein, lactose, total solid and solid non-fat content were quite low as compared to the standard value for buffalo milk. Antibiotic residues were not detected in the samples and the microbial number did not exceed the value stipulated by the Malaysia Food Regulations (1985). Thus, it can be concluded that buffalo milk produced in Kedah, Malaysia is of good quality.

**Keywords:** buffalo milk, milk quality parameter, buffalo (*Bubalus bubalis*)

**DETERMINATION OF ANTIMICROBIAL PROPERTIES OF  
SERUM FROM CAPTIVE ESTUARINE CROCODILE (*CROCODYLUS  
POROSUS*) AND FALSE GHARIAL (*TOMISTOMA SCHLEGELII*)**

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**ABSTRACT**

The serum of estuarine crocodile (*Crocodylus porosus*) and false gharial (*Tomistoma schlegelii*) were known to have antimicrobial properties. This allows crocodiles to live in marsh and highly pathogenic environment without the threat of fatal infections. This study determined the antimicrobial properties of serum from captive estuarine crocodile and false gharial. Blood samples from 2 estuarine crocodile and 2 false gharial were collected from the dorsal tail vein using 5 inch 18 G needles and 10 mL syringes. The antimicrobial properties of serum samples against 6 pathogenic bacteria were determined using the disc diffusion and Mueller Hinton agar zone-of-inhibition methods. The results showed that serum of captive estuarine crocodile and false gharial had no antimicrobial properties against *Escherichia coli*, *Salmonella sp*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Enterobacter cloacae* and *Pseudomonas aeruginosa*.

**Keywords:** estuarine crocodile, false gharial, antimicrobial properties

**DETERMINATION OF SEVERITY OF PNEUMONIA, RESPONSES TO HEAT SHOCK PROTEIN 90 AND CORTISOL CONCENTRATIONS IN VACCINATED AND NON-VACCINATED PNEUMONIC AND NON-PNEUMONIC GOATS**

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**ABSTRACT**

Pneumonic pasteurellosis, commonly caused by *Mannheimia haemolytica* and *Pasteurella multocida*, is a common respiratory disease of goats and sheep. Vaccination programme is the most cost-effective way to control the disease. Heat shock protein 90 (HSP90) is a stress protein that is involved in many body functions including protection of cells from stressors. This protein, like cortisol, increases in expression when animals are exposed to stress stimuli. There is paucity of information on the association between severity of pneumonia and responses of heat shock protein 90 (HSP90) and cortisol in vaccinated and non-vaccinated pneumonic goats. In this study, 76 goats were divided into three groups namely, normal vaccinated and non-vaccinated, vaccinated pneumonic, and non-vaccinated pneumonic group based on clinical signs. The severity of pneumonia, classified as mild, moderate or severe, was based on auscultation score. The HSP90 and serum cortisol Blood concentrations were determined the ELISA technique. The results showed that non-vaccinated pneumonic goats had higher auscultation scores than the other groups and they were shown to suffer from moderate to severe pneumonia. Vaccinated pneumonic goats showed mild pneumonia scores. Mean HSP 90 concentration for normal vaccinated and non-vaccinated group and vaccinated pneumonic group was  $32.9 \pm 4.21$  and  $33.78 \pm 5.71$  pg/mL, respectively. Non-vaccinated pneumonic goats showed approximately 1.6 times higher HSP 90 concentration ( $54.76 \pm 13.6$  pg/mL) than the other groups. The mean cortisol concentration was  $17.74 \pm 4.43$ ,  $22.98 \pm 4.71$ , and  $19.67 \pm 3.37$  pg/mL in normal vaccinated and non-vaccinated group, vaccinated pneumonic group, and non-vaccinated pneumonic group, respectively. In conclusion, the study showed that in pneumonia, although not significant, the vaccinated goats showed lower HSP 90 and cortisol concentrations than in non-vaccinated goats.

**Keywords:** pneumonic vaccine, severity, auscultation, HSP 90, cortisol

**CLINICOPATHOLOGICAL EVALUATION OF *OREOCHROMIS SP.*  
CHALLENGED WITH *STREPTOCOCCUS INIAE*  
AND *AEROMONAS HYDROPHILA***

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**ABSTRACT**

*Streptococcus iniae* can cause streptococcosis in marine and freshwater fishes. *Aeromonas hydrophila* can cause motile *Aeromonas* Septicaemia (MAS) or haemorrhagic septicemia, ulcers or red-sore disease in fishes. Both diseases may cause septicaemia and lead to economic losses to the farmers. The study evaluated clinical signs and pathological changes in brain, kidney, and gills of the Red hybrid tilapia (*Oreochromis sp.*) challenged with post-*Streptococcus iniae* and *Aeromonas hydrophila*. Fifty-four tilapia fingerlings were divided into three groups: infected intraperitoneally with  $1 \times 10^{10}$  cfu *S. iniae* or *A. hydrophila*, and non-treated control. Sampling was done at 12-h intervals for 48 h to determine macroscopic and microscopic post-mortem lesions. The clinical signs in *S. iniae*-infected fish were motionless, swimming at base of the tank, long white faeces, and anorexia. *A. hydrophila*-infect fish showed air gulping, anorexia, and death. Macroscopically, both groups developed in renal, gill, and brain inflammatory cell infiltration and congestion and fin haemorrhage. Exophthalmia was observed in *S. iniae*- while haemorrhagic operculum in *A. hydrophila*-infect fish. Other histopathological changes observed were vacuolation in the brain, renal tubular degeneration, and secondary lamella changes in the gills. The lesions were more severe in *S. iniae*- then *A. hydrophila*-infect fish. The results showed that fish infected with *S. iniae* may develop similar but more severe clinical signs and pathological changes than those infected with *A. hydrophila*.

**Keywords:** tilapia, *Oreochromis sp.*, *Streptococcus iniae*, *Aeromonas hydrophila*, histology

## **SURVEY ON THE AWARENESS OF RABIES AS A ZONOTIC DISEASE AMONG DOG OWNERS**

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### **ABSTRACT**

All mammals including human are susceptible to rabies. It is important for dog owners to be aware of this disease so that its transmission during handling infected animals can be minimised. This study was conducted to determine level of awareness of rabies as a zoonotic disease among dog owners consulting the University Veterinary Hospital (UVH), Universiti Putra Malaysia. A set of questionnaire consisting of multiple choice and closed-ended questions and various levels of responsiveness on rabies was distributed to dog owners over a period of 3 weeks. The data from 33 respondents were analysed using descriptive statistics. The majority of dog owners had low level 85% (n=28) of awareness of rabies. There was a significant association ( $p= 0.036$ ) between source of information with level of rabies awareness. Nine out of 20 dog owners (75%) who experienced dog bites or scratches did not seek medical treatment. The study shows that the level of awareness of rabies as zoonotic disease among dog owners was low.

**Keywords:** rabies, zoonotic disease, awareness, questionnaire, dog owner

## **AWARENESS AND KNOWLEDGE AMONG OWNERS ON CATS AS A SOURCE OF ZONOTIC DISEASES**

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### **ABSTRACT**

Keeping pets as a source of happiness and for companionship is on the increase. However, pet cats may harbour diseases harmful to unsuspecting owners. Thus, the aim of this study was to determine the level of awareness and knowledge owners on cats being potential reservoirs for diseases, especially sporotrichosis, dermatophytosis, and bartonellosis. A cross-sectional survey was conducted by distributing a set of questionnaires to cat owners to 100 respondents who consulted small animal clinics in Selangor, Malaysia during a 3-week study period. The majority of the respondents (81%) were not aware of zoonotic diseases and associated terminologies. Among cat owners, 54% were not aware of sporotrichosis, while 57 and 55 % had average knowledge on dermatophytosis and bartonellosis, respectively. No significant association ( $p>0.05$ ) was found between age and education and knowledge level on these diseases. There was significant association between awareness on sporotrichosis ( $p=0.006$ ) and bartonellosis ( $p=0.001$ ) and race. The study shows that there is need to improve methods of communication and dissemination of information to raise level of public awareness and reduce the risk of disease transmission through their pets.

**Keywords:** cats, zoonoses, awareness, knowledge gap

## **DETERMINATION OF FATTY ACID PROFILE IN JADE PERCH (*SCORTUM BARCOO*)**

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### **ABSTRACT**

Marine fishes are good sources of omega-3 polyunsaturated fatty acids (n-3 PUFAs) especially docosahexaenoic acid (DHA) and eicosapentaenoic acid (EPA). These omega-3 fatty acids can also be found in freshwater fish species, but the composition may vary. Freshwater fish cannot produce omega-3 fatty acid, thus, they depend on dietary supplementation. The aim of this study was to determine the relationship between feed and fatty acid profile in freshwater *Scortum barcoo* (Jade Perch). The fatty acid profile of 6 adult *S. barcoo* and feed samples were determined by total lipid extraction, fatty acid methyl esters (FAME) preparation, and gas-liquid chromatography. The results showed that only monounsaturated fatty acids (0.38%), example oleic acid (C18:1n-9), were detected in the feed. In fish meat, total PUFA was lower (4.24%) than the total SFA (6.96%). The proportion of total omega-3 PUFA was 1.70% and total of omega-6 PUFA was 2.54%. In addition, the ratio of omega-3 and omega-6 was 1:2. Unexpectedly, DHA and EPA were found in the fish meat at 1.45 and 0.25%, respectively, but not in the feed. The study suggests that freshwater *S. barcoo* is capable of converting short chain carbon such as oleic acid (C18:1n-9) from feed to long-chain carbon DHA (C22:6n-3).

**Keywords:** *Scortum barcoo*, fatty acid profiles, proximate analysis, docosahexaenoic acid, eicosapentaenoic acid

## **FACTORS MOTIVATING OWNERS TO VACCINATE THEIR CATS**

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### **ABSTRACT**

Regular vaccination plays an important role in the control of infectious diseases in cats. Poor compliance to the recommended vaccination programme is among the reasons for the continual threat of infectious diseases in cats. Therefore, this study aimed to determine factors that motivate owners to vaccinate their cats. Fifty-two cat owners consulting the University Veterinary Hospital, Universiti Putra Malaysia, were interviewed by questionnaire. The results showed that owners from the bottom 40% income group with household income of <RM3900, were four times less likely to vaccinate their cats than those of the higher income groups. Owners with good knowledge on vaccination practices were 6 times more likely to vaccinate their cats than those with poor knowledge. The number of people in the household, amount spent on the cat per month and owners' perception of the cat as a pet animal or family member, are among factors contributing to the decision to vaccinate cats. In conclusion, owners' income, knowledge on when to vaccinate, and ancillary cat ownership determinants, were important motivating factors for owners to vaccinate their cats. These factors should be considered when designing directed and effective client education programmes on vaccination compliance, particularly among cat owners.

**Keywords:** cat, vaccination, factors



## **GASTROINTESTINAL AND BLOOD PARASITES IN FREE RANGE TURKEYS IN SIMPANG RENGAM, JOHORE, MALAYSIA**

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### **ABSTRACT**

Free-range rearing is an integral part of turkey farming in most developing countries, including Malaysia. Currently, there are very few reports on gastrointestinal and blood parasites of free-range turkeys in Malaysia. Thus, the objective of this study was to determine the prevalence of gastrointestinal and blood parasites in free-range turkeys in Simpang Renggam, Kluang, Johore, Malaysia. Five free-range female turkeys were sampled for blood, faeces, and gastrointestinal tract tissues and content. The blood parasites detected were the *Leucocytozoon* spp. (20%) and *Plasmodium* spp. (40%). Three species of gastrointestinal parasite oocysts were detected. *Eimeria* spp. had the highest prevalence (60%) followed by *Heterakis gallinarum* (40%), and *Capillaria* sp. (20%). Gastrointestinal worms were also present in 3 turkeys, one with *Capillaria* spp. and 2 with Acanthocephalan worms. Overall, 40% of the turkeys were infected with blood and 80% with gastrointestinal parasites. This information can be used by veterinarians and farmers and veterinarians to develop strategies for treatment and control of endoparasitism in turkeys.

**Keywords:** turkey, free range, parasites, gastrointestinal, haemoparasite

## **PATHOGENICITY OF *SALMONELLA* *TYPHIMURIUM* AND *SALMONELLA* STANLEY ISOLATES IN CHICKENS**

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### **ABSTRACT**

Salmonellosis is a zoonotic and foodborne disease. Food animals such as chickens, turkeys and pigs are the most common reservoirs of the infection. The objective of this study was to determine the pathogenicity of *Salmonella* isolates in chickens. Seventy-six-day-old chicks were divided into three groups; group A, inoculated intraperitoneally with 0.1 mL  $1 \times 10^8$  cfu *S. Typhimurium* (n=24), and group B similarly inoculated with *S. Stanley* (n=24). Group C was the nontreated control (n=28). The chicks were provided feed and water *ad libitum* throughout the trial, and monitored for abnormal clinical signs and mortality at least twice daily. Prior to bacterial inoculation, 4 chicks from group C were sacrificed. Then 4 chicks from each group were sacrificed on days 1, 4, 7, and 14 post inoculation (pi). The body weights were monitored and blood sampled for the detection of *Salmonella* antibody using ELISA. At necropsy, gross lesions were noted and liver tissues were sampled for routine histopathology. Tissue samples from the liver, spleen, caecal tonsils and cloacal swabs were obtained for bacterial isolation and identification. The body weight of chicks in all groups increased throughout the trials. There was significant difference ( $p < 0.05$ ) in body weight between groups on day 1 pi only. One chick from group inoculated with *S. Typhimurium* died on day 8 pi and one a chick inoculated with *S. Stanley* developed weakness on day 6 pi and died the next day. Control chicks from group C did not show any abnormality. The rate of mortality was 12.5%, each for chicks inoculated *S. Typhimurium* and *S. Stanley*. No mortality was observed in the control chicks. Necropsy revealed splenomegaly in chicks infected with *S. Stanley*. There was no significant change in the liver histopathology in all chicks. *Salmonella* was isolated from splenic tissues (25%) of *S. Typhimurium*-infected chicks on day 1 pi and from liver (25%) on day 7 pi. In *S. Stanley*-infected chicks, on day 1 pi, *Salmonella* was isolated from the liver (25%) and caecal tonsil (25%), on day 4 pi from liver (50%), caecal tonsil (25%) and spleen (25%), on day 7 pi from liver (50%), spleen (50%), caecal tonsil (50%), and cloacal swab (50%). *Salmonella* antibody titres decreased in all groups during the trial. There was no significant ( $p > 0.05$ ) difference in antibody titre among groups on days 1 and 7 pi while significant ( $p < 0.05$ ) differences were noted on days 4 and 14 pi. In conclusion, *S. typhimurium* and *S. Stanley* are pathogenic to chicks and can cause mortality.

**Keywords:** *Salmonella typhimurium*, *S. Stanley*, broiler, pathogenicity

## HERBAL ANTI-DIARRHOEAL FORMULATION FOR PIGLETS

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### ABSTRACT

Enterotoxigenic *E.coli* (ETEC) is the major cause of piglet diarrhoea in commercial pig farms. The farm routine anti-diarrhoeal treatment usually involves improper usage of antimicrobials without proper veterinary diagnosis. This has led to the emergence of antimicrobial resistant strains of *E. coli* that is a huge concern for animal and human health. In this study, the efficacy of green tea and pomegranate extract in treatment of piglet diarrhoea was evaluated. Piglet faecal score, average daily gain and pre-weaning mortality were parameters used to determine efficacy of the extract. Piglets in the first treatment group were administered one dose of extract and those in second treatment group given 2 doses on days 1 and 22. The control group received farm routine anti-diarrhoeal treatment. The performance of the treatment was compared with that of the control group. The results showed no difference ( $p>0.05$ ) in the between performances of piglets given extract and those of the control group. However, piglets given 2 extract treatments had lower faecal scores, higher average daily gains, and lower pre-weaning mortality than those given one dose of the extract only.

**Keywords:** piglets, diarrhoea, green tea, pomegranate, faecal score

## **SALT LICK TOPOGRAPHY AND SPECIES PREFERENCE IN THE ROYAL BELUM RAINFOREST, PERAK, MALAYSIA**

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### **ABSTRACT**

A salt lick is a natural mineral deposit contain essential nutrients like calcium, magnesium, sodium and zinc that is used by animals in the wild, to supplement dietary nutritional deficiencies. The purpose of the salt lick is to ensure that animals, especially herbivores, can obtain the necessary minerals in the diet. The salt licks also serve as a rally point for various wildlife species. In this study, salt licks were used to identify animal population, species, food chain, ecosystem and for other biological purposes. Thus, the objective was to determine the relationship between the geographical characteristics of salt licks in the Royal Belum Rainforest, Perak, Malaysia and the fauna species at the salt licks. The locations of the salt licks identified were Sira Kuak, Sira Batu, and Sira Tahan and their topography differed in size, ease of access, type of vegetation, and closeness to rivers. Camera traps were placed in strategic locations facing the salt lick to identify species of animal frequenting the salt lick. The differences in topography played a role towards the preference of species of wild animals for the salt lick. This study suggests that topography is a crucial attraction factor for wildlife species to frequent salt licks.

**Keywords:** salt lick, topography, rainforest, wildlife

## MICRO-CT EVALUATION OF ALVEOLAR BONE MICROMORPHOLOGICAL CHANGES IN EXPERIMENTALLY INDUCED PERIODONTAL DISEASE IN THE RAT MODEL

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### ABSTRACT

Periodontitis is driven by dysbiotic of periodontopathogenic bacteria that may lead to alveolar bone loss. The purpose of this study was to evaluate the alveolar bone micromorphological changes induced by ligature, injection of *Porphyromonas gingivalis* lipopolysaccharide (*Pg*-LPS) and a combination of ligature-*Pg*-LPS injection in the rat model. Micro-CT scanned data from 72 hemimaxilla of previously induced rats were analysed using Skyscan CT-analyser. Four groups of 18 Sprague-Dawley rats each, either served as non-treated controls, or treated with bilateral nylon string ligature on 2nd upper molar (Ligature), intra-gingivally injected with *Porphyromonas gingivalis* lipopolysaccharide (*Pg*-LPS), or ligature and with *Pg*-LPS intra-gingival injection (Ligature-*Pg*-LPS) for periods of 7 (n=6), 14 (n=6), or 30 (n=6) days. Ligature treatment produced periodontal disease as early as day 7 post-treatment. At day 7, both Ligature and Ligature-*Pg*-LPS group of rats showed significant decrease in percentage of bone volume (BV/TV), trabecular thickness (TbTh), and bone mineral density (BMD), but increase in total porosity (PoTot), suggestive of bone resorption. The *Pg*-LPS group did not show significant change in these parameters. The abnormalities in the treated bones gradually reduced, and by day 30, became insignificant ( $p>0.05$ ) when compared to the control group. This improvement in bone structure suggests bone remodeling. These results also showed that Ligature and Ligature-*Pg*-LPS treatments caused more bone resorption than *Pg*-LPS treatment alone in rats. This study showed that either ligature or ligature in combination with *Pg*-LPS is feasible to induce experimental acute periodontal disease.

**Keywords:** bone mineral density, periodontal disease, ligature, *Porphyromonas gingivalis*-lipopolysaccharide, micro-CT

## **PREVALENCE OF CARDIOMYOPATHY IN APPARENTLY HEALTHY CATS**

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### **ABSTRACT**

Heart diseases in cats often associated with congestive heart failure due to the combination of abnormalities in structure and function of the cardiac muscles. This retrospective study determined the prevalence of cardiomyopathy in apparently healthy cats referred to the University Veterinary Hospital, Universiti Putra Malaysia in 2016 to 2017. The mean age of cats was 4.9 years (7 months to 19-years old). The prevalence of cardiomyopathy among 59 apparently healthy cats was 40.7%, with hypertrophic cardiomyopathy (62.5%) as the most common type of cardiomyopathy diagnosed, followed by restrictive cardiomyopathy (25.0%), interventricular septal defect (4.2%), left ventricular outflow tract obstruction (4.2%), and systolic anterior motion (SAM) of the mitral valve (4.2%). The prevalence was higher in males (45.0%) and in the domestic short haired cats (46.0%). Among apparently healthy cats with vertebral heart size (VHS) of > 8.0, only 52% were diagnosed with cardiomyopathy. However, 33% of the cats with normal VHS were diagnosed with heart disease. Consistently, all apparently healthy cats with abnormal heart sound were diagnosed with heart disease. Among cats with normal heart sound, 31.4% had cardiomyopathy. There is not association between occurrence of cardiomyopathy in apparently healthy cats and age, sex, and VHS. Echocardiography remains the best diagnostic tool for heart diseases in cats.

**Keywords:** feline, healthy, cardiomyopathy, prevalence

## **PREVALENCE OF ECTO- AND ENDOPARASITES IN PET DOGS PRESENTED TO VETERINARY CLINICS IN KLANG VALLEY, MALAYSIA**

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### **ABSTRACT**

Malaysia is a tropical country with hot and humid weather all year round that provides a suitable environment for the survival of parasites. Thirty pet dogs from selected veterinary clinics in Klang Valley, Malaysia, were recruited for the study. Ectoparasites, faeces, and blood were collected for analysis. The ectoparasites were subjected to morphological identification. Faecal samples were subjected to Baermann-Wetzel, floatation and sedimentation techniques for the detection of lungworms and intestinal helminths. The Snap 4Dx Plus test was used to determine presence of antibodies to *Ehrlichia* spp., *Anaplasma* spp., *Borrelia burgdorferi*, and *Dirofilaria immitis*. The Snap Leishmania test was used to determine presence of antibodies against *Leishmania* spp. Two dogs were infested with *Ctenocephalides felis* and two with *Rhipicephalus* sp. Five dogs were infested with intestinal helminths, which were identified as *Ancylostoma* sp. (16.67%), and one (3.33%) with *Trichuris* sp. infestation. The serological prevalence was 10% for *Anaplasma platys*, 6.67% for *Dirofilaria immitis*, and 6.67% for *Ehrlichia canis*. All samples were negative for *Borrelia burgdorferi* and *Leishmania infantum* antibodies. The study showed that the prevalence of parasites in pet dogs in Klang valley was low. However, infected pet dogs still pose a zoonotic risk that necessitates routine parasitic control.

**Keywords:** pet dogs, ectoparasite, intestinal helminth, vector-borne, prevalence

**DETECTION OF ANTIBODIES AGAINST *LEPTOSPIRA* SEROVARS  
IN DOGS AND CATS IN AN INDIGENOUS VILLAGE, BELUM,  
PERAK, MALAYSIA**

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**ABSTRACT**

Leptospirosis is a re-emerging disease affecting human and animals. There are very studies on leptospirosis among dog and cat populations in Malaysia. The present study population is located at Tiang River, Belum, Perak, Malaysia. The presence of large water bodies, wild rodents, and stray dogs and cats predisposed the Belum indigenous people to leptospirosis. In this study, blood samples from 37 dogs and 3 cats were collected to determine leptospiral infection and identify their serovars. Microscopic agglutination test was used to determine the presence of anti-leptospiral antibodies in serum samples. The test panel included 12 common serovars of *leptospira*: *Canicola*, *Pomona*, *Icterohaemorrhagiae*, *Grippityphosa*, *Australis*, *Pyrogenes*, *Lai*, *Celledoni*, *Bataviae*, *Javanica*, *Hardjo*, and *Copenhageni*. Three of 37 dogs (8.1%) and one of three cats (33.0%) were seropositive for *Leptospira* at cut-off titre of 1:100. The most predominant serovar identified among the dog samples was *Celledoni* (5.4%), followed by *Australis* (2.7%), and *Lai* (2.7%). Serovar *Lai* was detected in one cat. These findings suggest that indigenous people are at risk of acquiring leptospirosis from animals.

**Keywords:** leptospira, seroprevalence, dogs, cats, indigenous people



## **PREVALENCE OF HAEMOTROPIC MYCOPLASMOSIS IN STRAY AND PET CATS IN KLANG VALLEY, MALAYSIA**

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### **ABSTRACT**

Hemotropic mycoplasmosis is a clinically significant disease of cats with the potential to cause severe and fatal haemolytic anaemia. Despite the importance of this disease, there is a lack of information on its prevalence in cats in Malaysia. Therefore, this study was conducted to determine the molecular prevalence of haemotropic mycoplasmosis in stray and pet cat populations in Klang Valley, Malaysia and to identify risk factors for the infection. Thirty-three plasma samples from stray cats at Dewan Bandaraya Kuala Lumpur, Malaysia pound and 30 from pet cats presented to University Veterinary Hospital, Universiti Putra Malaysia, were used. DNA extraction was performed on all samples, followed by polymerase chain reaction using HBT-F and HBT-R primers for amplification of the 16S rRNA gene sequences of the two most common species, *Mycoplasma hemofelis* and *Candidatus mycoplasma haemominutum*. The study showed that 42.9% (27/63) of the samples tested positive for both *Mycoplasma* species. The prevalence for *M. hemofelis* was 4.8% and for *Candidatus mycoplasma haemominutum* 38.1%. Cats with outdoor access were 2.5 times more likely to be positive for haemotropic mycoplasmosis. Overall there is a high prevalence of hemotropic mycoplasmosis both in stray and pet cat population in Klang Valley, Malaysia, emphasising the need for improved preventive measures.

**Keywords:** polymerase chain reaction, haemotropic mycoplasmosis, stray and pet cats

## **ASSESSMENT OF CHEMORECEPTIVITY IN GOLDFISH (*CARASSIUS AURATUS*) FINGERLINGS TO DETERMINE THE NATURAL ATTRACTANTS FOR FEED FORMULATION**

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### **ABSTRACT**

Goldfish (*Carassius auratus*) is one of the most popular ornamental fishes for hobbyist and usually kept in large numbers in aquarium or ponds. The type of feed and feeding routine are crucial in the prevention of overfeeding that could cause pollution of the aquarium. The objectives of this study were to assess chemoreceptivity in goldfish fingerlings, the chemoreceptivity between commercial fish pellet and the live feed, and to suggest a formulation for the best diet using live food supplementation as feed attractants in commercial pellet. In this experiment, the feeding behaviour of the goldfish were recorded using GoPro™ video recorder for 15 min following feeding with six different pairs of feed formulations. The results showed that the average time spent on bloodworm was the longest, followed by brine shrimp and mosquito larvae, while commercial pellet was the shortest. In addition, the most preferred entries, in order, were bloodworm, brine shrimp, mosquito larvae, and commercial pellet. The study showed that goldfish was more receptive to live fresh feed than commercial fish pellets.

**Keywords:** chemoreceptivity, live feed, commercial feed, time spent, *Carassius auratus*

## LIPID SIGNALLING GENE EXPRESSION LEVEL IN HEPG2 CELLS SUPPLEMENTED WITH EXOGENOUS LIPID AND EDIBLE BIRD NEST EXTRACT

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### ABSTRACT

“Caviar of the East” or better known as edible bird nest (EBN) is a highly valuable product composed of solidified salivary secretion of a few insectivorous swiftlet species. Swiftlets falls under the family Apodidae and the two main genera with the highest commercial values are *Aerodramus* (echolating swiftlets) and *Collocalia* (non-echolating swiftlets). The objective of this study is to determine the qualitative genes expression level associated with lipid signalling pathway; Acetyl-CoA acetyltransferase 2 (ACAT2), Diacylglycerol O-acyltransferase 2 (DGAT2), low density lipoprotein receptor (LDLR), sterol regulatory element binding transcription factor 2 (SREBP2), 3-hydroxy-3-methylglutaryl-CoA reductase (HMGCR), Proprotein Convertase Subtilisin/kexin type 9 (PCSK9) in HepG2 cells with and without supplementation of EBN extract and exogenous lipid. Raw EBN were manually cleaned, dried in oven at 60°C and left overnight. Then, EBN supernatant was mixed with acetone at 1:2 ratio and kept under -80°C for one hour. HepG2 cells were cultured in six wells plates and each wells were treated according to its respective treatments with Base Control: 99% AMEM and 1% FBS (Complete media), Negative Control: Complete media with 250X Cholesterol Lipid Concentrate and 2.5mg/mL Low-Density Lipoprotein from human plasma, Positive Control: Negative Control with addition of Simvastatin, Treatment 1: Negative Control with supplementation of 0.5 mg/mL EBN, Treatment 2: Negative Control with supplementation of 1.0 mg/mL EBN, and Treatment 3: Negative Control with supplementation of 1.5 mg/mL EBN. The study showed that EBN extract and lipid treatments significantly increased ( $p < 0.05$ ) ACAT2 and LDLR and may reduce PCSK9 gene expressions in HepG2 cell. Thus, EBN extract may potentially play a role in lowering risk of developing atherosclerosis.

**Keywords:** edible bird nest, *Aerodramus* spp., lipid metabolism, genes expression, qualitative PCR

## **SEVERITY OF PNEUMONIA AND BLOOD HEAT SHOCK PROTEIN-70 CONCENTRATION IN VACCINATED AND NON-VACCINATED PNEUMONIC GOATS**

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### **ABSTRACT**

Pneumonic pasteurellosis caused by *Pasteurella multocida* or *Mannheimia haemolytica* serotype A2, A7, and A9, is the second most important infectious disease in small ruminant. Heat shock protein such as Hsp70 is a major stressed-induced protein that plays a key role in the destruction of pathogens and increase of host resistance to chemical stresses. Hsp70 is a molecular chaperone that can be a vital biomarker in the diagnosis of bacterial diseases in small ruminants. This study determined the association between severity of pneumonia and response of Hsp70 in vaccinated and non-vaccinated pneumonic and non-pneumonic goats. Thirty vaccinated and 46 non-vaccinated goats were selected from four small ruminant farms in Selangor, Malaysia. Based on clinical examination, the animals were grouped into normal vaccinated and non-vaccinated, vaccinated pneumonic, and non-vaccinated pneumonic groups. The severity of pneumonia was determined by lung auscultation scoring and categorised as mild, moderate or severe. Blood samples from these goats were subjected to Hsp70 analyses using ELISA. The findings showed that Hsp70 concentration is higher in non-vaccinated pneumonic than vaccinated pneumonic goats. The Hsp70 concentration, although not significant, was observed to be higher by 40% in vaccinated pneumonic and 50% in non-vaccinated pneumonic than in normal goats. The pneumonia clinical signs in non-vaccinated were approximately 50% more severe than in vaccinated pneumonic goats. The study also showed that Hsp70 concentration was slightly higher in non-vaccinated pneumonic than vaccinated pneumonic goats. In conclusion, the results showed that the blood Hsp70 concentration may be associated with severity of pneumonia in goats.

**Keywords:** pneumonia, goats, severity, clinical signs, heat shock protein, Hsp70, vaccine

## **A SURVEY ON THE AWARENESS OF PET OWNERS TOWARDS THE PET FOOD LABEL**

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### **ABSTRACT**

Pet food label is a legal document of the Association of American Feed Control Officials and is the primary means of communication between the pet food manufacturers and pet owners. Balance nutrients must be provided at a specific age and life-stage to ensure proper development and growth of the pets. Pet owners should be aware of food categories, ingredients, feeding guide, and packaging labels, to ensure delivery of appropriate amount and required type of nutrients to their pets. The objectives of the study were to determine the level of and factor contributing to awareness of pet owners on pet food labels. A questionnaire survey was conducted on 150 pet owners consulting the University Veterinary Hospital, Universiti Putra Malaysia and the Companion Animal Clinics in Klang Valley, Malaysia. The results showed that the awareness of pet owners on the pet food labels was low. The main contributing factors to the awareness of pet owners on the pet food labels were font size and customer review charts.

**Keywords:** pet food label, pet owners, questionnaire, awareness

## **HISTOPATHOLOGICAL COMPARISON BETWEEN EXPERIMENTAL *STREPTOCOCCUS AGALACTIAE* AND *STREPTOCOCCUS INIAE* INFECTIONS IN RED HYBRID TILAPIA**

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### **ABSTRACT**

*Streptococcus agalactiae* and *streptococcus iniae* are the two main pathogens contributing to streptococcosis in fish, a disease responsible great economic loss to aquaculture industry. The aim of this study was to compare the histopathological findings caused by *S. agalactiae* and *S. iniae* experimental infections in Red Hybrid Tilapia (*Oreochromis* sp). Two experiments were conducted. In the first experiment, 60 healthy fish of size < 4” were divided equally into three groups; two control (n=20) and two treatment groups (n=20). The treatment group was intraperitoneally treated with either sterile 0.03 mL/g  $1 \times 10^7$  cfu/mL *S. agalactiae* (n=10) or *S. iniae* (n=10) in PBS. In the second experiment (n=60), the fish of size > 4” were similarly grouped and treated. All fish were observed every 6 h for 5 d. During the observation period, dead fish was subjected to necropsy. After the observation period, the remaining fish were euthanised and subject to necropsy. Spleen, liver, and brain samples were collected and fixed in 10% neutral buffered formalin for routine histopathological examination. Gross lesions observed include cerebral oedema, ascites, integumentary haemorrhage, presence of pustules, and intestinal congestion. Organ tissue sections were examined microscopically and lesions were described and scored. Infiltration of inflammatory cells and haemorrhage were the most frequently observed lesions observed in infected groups,. Regardless of the size, all fish infected with *S. agalactiae* showed significantly ( $p < 0.05$ ) more severe lesions than those infected with *S. iniae*. Fish of >4” in size were more susceptible to streptococcal infections and showed more severe lesions than those <4” in size. *S. agalactiae* was more pathogenic than *S. iniae* to the Red Hybrid Tilapia.

**Keywords:** Streptococcosis, *Streptococcus agalactiae*, *Streptococcus iniae*, histopathology, red hybrid tilapia

**A RETROSPECTIVE STUDY ON CANCER CHEMOTHERAPY PRACTICES IN DOGS AND CATS AT UNIVERSITY VETERINARY HOSPITAL, UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

University Veterinary Hospital (UVH), Universiti Putra Malaysia provide chemotherapy for small animal cancers. Information on the frequency and type of cancers commonly treated with cytotoxic injectable chemotherapy is limited in Malaysia. The objectives of this study were to determine the frequency and types of cancer, chemotherapeutic drug used, frequency of delivery, side effects, and costs incurred in the treatment of cancers in dogs and cats presented to UVH between 2013 and 2017. The data collected was subjected to descriptive analysis using SPSS version 20.0. A total of 83 dogs and 30 cats, received cytotoxic cancer chemotherapy at UVH during the period. A total of 429 doses (78%) of injectable cytotoxic drugs were delivered to dogs and 123 doses (22%) to cats. The most common cancer treated in dogs was transmissible venereal tumour while in cats, it was lymphoma. Vincristine is the most frequently used injectable cytotoxic anti-cancer chemotherapy drug with a total of 474 doses delivered over the 5-year period. The common side effects of chemotherapy in dogs and cats were anaemia and thrombocytopaenia, with one case of drug extravasation tissue reaction in a cat. The average cost for chemotherapy delivery per visit regardless of species was RM 247.

**Keywords:** cancer chemotherapy, University Veterinary Hospital, Universiti Putra Malaysia, transmissible venereal tumour, lymphoma, anaemia, vincristine

**SEROLOGICAL AND MOLECULAR INVESTIGATION ON  
WEST NILE VIRUS AMONG WILD BIRDS IN  
KUALA GULA, PERAK, MALAYSIA**

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**ABSTRACT**

West Nile Virus (WNV) is a zoonotic arthropod-borne virus derived from Flaviviridae family. The virus infection is commonly transmitted by mosquitoes. Wild birds act as the natural amplifying reservoir while mammals served as dead-end host. A previous study on companion birds in Selangor showed that the vector for WNV is presence in Malaysia. Therefore, this study was undertaken to screen for WNV antibody and antigen in Ardeidae (wild birds) at the Kuala Gula Bird Sanctuary, Perak, Malaysia, a high-risk area because it is one of the stops for the migratory bird. Twenty Ardeidae juvenile and adult birds were obtained through convenience sampling. Serum and oropharyngeal swabs were collected and subjected to competitive ELISA (ID Screen ® West Nile Competitive Multi-species) and one step rt-PCR targeting highly conserved gene in the capsid and pre-membrane protein, respectively. The results showed that 2/20 samples were positive to the pr-E antigen. Five samples were positive for WNV antigen. The positive bands showed 98 to 100% homology with the WNV strains from Italy, United State, Hungary, Russia and Greece. The study showed that the Ardeidae family of wild birds in Malaysia had been exposed to and infected with WNV.

**Keywords :** West Nile Virus (WNV), Flaviviridae, wild birds, ELISA, rt-PCR, Perak



## **PREVALENCE OF FASCIOLIASIS IN CATTLE AND GOATS SLAUGHTERED AT SHAH ALAM ABATTOIR, MALAYSIA**

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### **ABSTRACT**

Fascioliasis in livestock is veterinary and public health importance causing serious economic losses. However, there are very little data on the occurrence of fascioliasis in abattoirs in Malaysia. The present study investigated the prevalence of fascioliasis in cattle and goat slaughtered in the Shah Alam abattoir, Malaysia. The convenience sampling method was used to determine the prevalence of *Fasciola* sp. in the abattoir. Liver samples were examined for abnormalities and bile ducts incised to determine presence of the parasite. Only one of 80 liver samples were positive for *Fasciola gigantica* with 25 flukes. All goat liver samples were negative for *Fasciola* sp.

**Keyword:** fascioliasis, cattle, goat, abattoir, fluke, prevalence

**A RETROSPECTIVE STUDY ON THE ACUPUNCTURE PRACTICES IN DOGS IN SELECTED VETERINARY CLINICS IN KLANG VALLEY, MALAYSIA**

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**ABSTRACT**

Acupuncture has been widely used as adjunct therapy to conventional western veterinary medicine. Due to lack of data on veterinary acupuncture in dogs in Malaysia, a retrospective study was conducted to document the distribution of acupuncture cases, methods used, concurrent acupuncture treatments, subjective outcomes and side effects in dogs treated with acupuncture. Medical records of dogs that underwent acupuncture therapy at two selected certified veterinary clinics in Klang Valley from January to December 2017 were reviewed. A total of 194 acupuncture cases in dogs were recorded. Patients presented were mainly geriatrics (71%). Small breed dogs made up 49% of the overall number of acupuncture cases. The most common complaints presented were neurological problems (40.9%) followed by orthopaedic problems (27.4%). Intervertebral disc disease (IVDD) (56.3%) and arthritis (46.3%) were the predominant issues at these clinics.

**Keywords:** veterinary acupuncture, dog, orthopaedic, neurological

## **PATHOLOGICAL CHANGES IN GILLS, LIVER, AND KIDNEYS OF GOLDFISH (*CARASSIUS AURATUS*) EXPOSED TO CLOVE OIL USING THE FISH ANAESTHESIA DELIVERY SYSTEM**

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### **ABSTRACT**

General anaesthesia is widely used in aquatic animals for many purposes including major and minor surgeries and research. Clove oil is among the anaesthetic agents uses for general anaesthesia in fish. In this study, the pathological changes in gills, liver and kidney of Goldfish (*Carassius auratus*) following exposure to clove oil using the fish anaesthesia delivery system was determined. The Goldfish were grouped in separate tanks according to duration of maintenance stage during surgery. Three treatment groups (n=5/group) were each exposed 50 mg/L clove oil and fish from each group were subjected to either 5, 15, or 30 min surgery simulation using the fish anaesthesia delivery system. The fourth group (n=5) were nontreated control that was free from exposure to clove oil and anaesthetic agent. The gills, kidney and liver were sampled from each group for macroscopic and microscopic evaluation. The results revealed that although there were no gross changes, the treated fish showed epithelial swelling, epithelial lifting, oedema, and dilatation of blood vessels in the gills. The highest lesion scoring was observed in fish subjected to 30 min surgery simulation. The results showed that clove oil did produce abnormal macroscopic or microscopic change in the kidneys and liver of Goldfish. In conclusion, this study showed that 5 and 15 exposure to clove oil during surgery is relatively safe to the Goldfish. The fish anaesthesia delivery system using clove oil can be optimal for the conduct of minor surgical procedures in Goldfish.

**Keywords:** clove oil, Goldfish (*Carassius auratus*), pathological changes, gills, liver, kidney, fish anaesthesia delivery system

**IN VIVO ASSESSMENT OF ACUTE TOXICITY OF JUVENILE RED HYBRID TILAPIA (*OREOCHROMIS SP.*) EXPOSED TO ROUNDUP® (GLYPHOSATE- BASED) HERBICIDE**

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**ABSTRACT**

Malaysia depends heavily on agriculture and herbicides are commonly used as weed-killers in vegetable farms and orchards. Glyphosphate-based herbicide is one of the most used herbicides in Malaysia. Herbicides can quality of water sources and the environment. In this experiment, 25 juvenile Red Hybrid Tilapia were exposed to various concentrations of Roundup® (glyphosate-based herbicide) for 24 h. The behaviours of the fish were recorded. At end of the experiment the fish were sacrificed by severing the spinal cord and the gills and brains collected. There were irregular behavioural changes concentration of herbicide and time of exposure. The fish showed gasping, loss of balance, dullness, settled at the bottom of the tank, and eventually die. Gill histology showed epithelial oedema, lifting, and fusion of secondary lamellae, thickening (hyperplasia) of primary lamellae, and congestion of blood vessels in the primary and secondary lamellae. Brain histology revealed congestion of cerebral blood vessels, slight congestion in granular and molecular layers of cerebrum, demyelination of neuron cells, infiltration of inflammatory cells and vacuolated degeneration in the molecular layer. The lethal dose at 50% mortality (LD<sub>50</sub>) of Roundup® herbicide, determined using Karber method, was 14mg/L.

**Keywords:** herbicide, glyphosate, histology, gills, brain, Red hybrid tilapia

**A RETROSPECTIVE STUDY OF CATS WITH HEAD TRAUMA AT  
UNIVERSITY VETERINARY HOSPITAL,  
UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

Head trauma is a common cause of morbidity and mortality in dogs and cats, mostly due motor vehicle accidents. Decision making on stabilisation and treatment are significantly dependent on severity of the injury hence prompt assessments are crucial to prevent morbidity. Imaging of the skull are often necessary to identify injury that may not be recognised during physical examination. Despite the high occurrence in cats, clinical evidences of feline head injury in Malaysian setting is limited. In this study, the medical records for cats with head trauma presented to University Veterinary Hospital, Universiti Putra Malaysia from January 2016 to December 2017 were evaluated. Basic information were recorded according to the following categories; signalment, cause, presenting sign, imaging finding, and mortality rate. Laboratory parameters, modified Glasgow Coma Scale (MGCS), Animal Trauma Triage (ATT) and mentation scores were compared between survivor and non-survivor groups to evaluate prognostic value. One hundred thirty-three cats with age ranging from 1 month to 18 years, were recruited in the study. The Domestic Shorthair cats (87%,  $n=115$ ) was the dominant breed. Young cats aged between 7 to 24 months (40%,  $n=50$ ) were prone to head trauma due to their higher activity level. The most common cause of head trauma in cats was motor vehicle accident (70%,  $n=98$ ), which resulted in various facial injuries including epistaxis (49%). Mandibular and maxillary fractures accounted for 43 ( $n=46$ ) and 38% ( $n=40$ ) of cases, respectively. The mortality rate reported in this study was 22% ( $n=29$ ). No significant difference ( $p>0.05$ ) in laboratory parameters was found between survivor and non-survivor groups, although decreased MGCS, increased ATT, and mentation scores were predictors for mortality. The MGCS, ATT, and mentation scores were easily measured severity scores and were found to be useful in predicting prognosis in emergency cases; however prospective studies are warranted to validate these factors.

**Keywords:** head trauma, cats, mortality rate, modified Glasgow Coma Scale, prognosis

**NASAL CARRIAGE OF METHICILLIN-RESISTANT  
STAPHYLOCOCCUS AUREUS AND METHICILLIN-RESISTANT  
STAPHYLOCOCCUS INTERMEDIUS GROUP IN RESIDENT COMPANION  
DOGS, CATS, ENVIRONMENT, AND PERSONNEL OF  
UNIVERSITY VETERINARY HOSPITAL,  
UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

Multidrug-resistant staphylococcal strains are on the increase worldwide. These bacteria are resistant mainly to  $\beta$ -lactamase antibiotics. This study determined the occurrence of methicillin resistant *Staphylococcus aureus* (MRSA) and methicillin resistant *Staphylococcus intermedius* group (MRSIG) among resident cats, dogs, and personnel and in the environment of University Veterinary Hospital (UVH), Universiti Putra Malaysia (UPM). Thirty-three nasal swabs samples were collected from resident dogs (=7) and cats (n=6), personnel (n=10), and the environment (n=10). All Staphylococcal isolates were confirmed using catalase, coagulase test and biochemical tests. Four Staphylococcus species were identified; *S. aureus* (n=10/23, 43%), *S. pseudintermedius* (n=5/23, 22%), *S. intermedius* (n=1/23, 4%), and *S. hyicus* (n=2/23, 9%). Using the selective media mannitol salt agar with and without supplementation of oxacillin, 2 isolates were identified as MRSA and one as MRSIG. The isolates were subjected to antimicrobial susceptibility profile using 8 commonly used antibiotics. Four isolates were of multi-drug resistant strain. All Staphylococcal isolates were sensitive to amikacin, vancomycin, and imipenem. The isolates were resistant to oxacillin (15%), gentamycin (20%), enrofloxacin (15%), and tetracycline (30%). This study shows that MRSA and MRSIG are prevalent in UVH, UPM.

**Keywords:** methicillin resistant *Staphylococcus aureus*, *Staphylococcus intermedius* group, University Veterinary Hospital, Universiti Putra Malaysia, antibiotic resistance

## **EFFECT OF PROPOFOL AND THIOPENTONE SODIUM ON PERIOPERATIVE HYPOTHERMIA IN CATS AND DOGS UNDERGOING VARIOHYSTERECTOMY**

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### **ABSTRACT**

Perioperative hypothermia is a usual and treatable complication in patients under general anaesthesia (GA). Different induction agents may cause different levels of hypothermia and time taken to recovery. The objective of this study was to compare the effect of propofol and thiopentone sodium in the induction of GA in cats and dogs. Nine cats and 6 dogs undergoing ovariohysterectomy (OHE) were used in the study. Oesophageal probes and digital rectal thermometers were used to measure the patient core body temperature from time of admission until achievement of normothermia (>37.5°C). Time to recovery was recorded from the cessation of inhalants until the animals were in sternal recumbency. There was no significant difference between propofol and thiopentone sodium as induction agent on the level of perioperative hypothermia, achievement of normothermia, recovery time, or recovery score in cats. Propofol resulted in shorter recovery time compared to thiopentone sodium in dogs. In conclusion, the induction agents did not have significant ( $p>0.05$ ) effect on perioperative hypothermia in either in dogs or cats. Although recovery time was shorter with propofol in dogs, it did not differ with induction agent in cats.

**Keywords:** propofol, thiopentone sodium (thiopental), perioperative hypothermia, recovery, cat, dog

## **FACTORS MOTIVATING OWNERS TO VACCINATE THEIR DOGS**

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### **ABSTRACT**

Vaccination is an essential in the prevention of disease spread in animals. As maternally derived antibody wanes, vaccines are given to the animal to boost immunity and provide protection against diseases. Malaysian pet owners often do not vaccinate their dogs. There is need to understand the reasons behind their reluctance to vaccinate pets. Thus, the objectives of this study were to determine factors that prompt and motivate owners to vaccinate their dogs and their level of awareness and knowledge on vaccination. The study was conducted by questionnaire on 40 responding dog owners consulting the University Veterinary Hospital (UVH), Universiti Putra Malaysia (UPM). The inclusion criteria were dogs presented at UVH either for checkup or treatment. The results showed that factors influencing owners to vaccinate their dogs were household income, education level, number of people and dogs in the household, and amount of money spent monthly on dogs. The results also indicated that higher owner awareness on vaccination is associated with higher compliance to vaccination. The information obtained in this study can be used for client education.

**Keywords:** dogs, vaccination, owners, motivation



## SEVERITY OF PNEUMONIA AND ACUTE PHASE PROTEIN CONCENTRATIONS IN VACCINATED AND NON-VACCINATED PNEUMONIC GOATS

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### ABSTRACT

Pneumonic pasteurellosis or respiratory manheimiosis in small ruminants is caused by *Mannheimia haemolytica*. The bacteria are encapsulated, gram-negative, small, aerobic coccobacilli and is a normal flora of nasopharynx and tonsils of healthy small ruminants. Haptoglobin (Hp) and serum amyloid A (SAA) are major positive acute phase proteins in small ruminants than can be use as biomarkers of inflammation and infection in small ruminants. This study was undertaken to determine the relationship between severity of pneumonia and response of acute phase proteins in vaccinated and non-vaccinated pneumonic and non-pneumonic goats. Thirty vaccinated and 46 non-vaccinated goats were selected from four small ruminant farms. The animals were grouped based on clinical examination into three groups, namely, normal vaccinated and non-vaccinated group, vaccinated pneumonic group, and non-vaccinated pneumonic group. The severity of pneumonia determined based on scoring of lung auscultation was classified as mild, moderate and severe. Blood samples were collected from these goats and the sera subjected to Hb and SAA analyses using ELISA. Based on lung auscultation score, the vaccinated pneumonic goats had mild and the non-vaccinated moderate pneumonia. The serum Hp and SAA concentrations, although not significant ( $p>0.05$ ), were 1.5 and 1.4 times higher, respectively, in non-vaccinated pneumonic goats than vaccinated pneumonic goats. Thus, the study showed that the severity of pneumonia and acute phase protein concentrations were higher in non-vaccinated than vaccinated goats.

**Keywords:** pneumonia, vaccine, clinical signs, severity, acute phase protein, haptoglobin, serum amyloid A.

**A RETROSPECTIVE STUDY ON CANINE  
KERATOCONJUNCTIVITIS SICCA AT THE REFERRAL EYE  
CLINIC, ANIMAL MEDICAL CENTRE,  
KUALA LUMPUR, MALAYSIA**

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**ABSTRACT**

Keratoconjunctivitis sicca (KCS) or dry eye disease is the condition characterised by inadequate production of the aqueous portion of the tear film by the lacrimal gland and/or gland of the third eyelid gland. There is currently no study in Malaysia on KCS and its clinical presentations. The aim of the study was to determine the trend of KCS in dogs presented to the Referral Eye Clinic, Animal Medical Centre (AMC) in 2017 and the relationship between the condition and breed, sex, and age. A descriptive retrospective study included cases presented with primary and secondary KCS. All patients were evaluated based on the presence of eye discharge, corneal discoloration, vascularisation, entropion or distichia, Shirmer's tear test, tonometry, tear break-up time, fluorescent stain, and other eye conditions. Two hundred and three cases of positive KCS cases were chosen for the study. Small breed dogs showed the highest occurrence of KCS at 66.5%. Of the 203 KCS cases, 47.3% were females and 52.7% were males. The highest percentage (18.2%) of dogs with KCS were those aged 10 to < 12 years old. There was no significant association ( $p>0.05$ ) between KCS and breed, sex and age of dogs.

**Keywords:** keratoconjunctivitis sicca, dog, breed, dry eye disease

## **DETECTION OF *BARTONELLA* SPP. IN CATS AT ANIMAL SHELTERS IN SELANGOR AND PUTRAJAYA, MALAYSIA**

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### **ABSTRACT**

The zoonotic nature of the bacterial genus *Bartonella* has long been known. The capability of the bacteria to infect humans and cause a variety of diseases and complications in immunocompromised individuals is a threat to public health. There is limited information on the prevalence of Bartonellosis in cats in Malaysia. This study determined the prevalence of *Bartonella* spp. in shelter cats in Selangor and Putrajaya, Malaysia. As flea is one of the most important vectors for transmission of pathogens, they were also subjected to detection of *Bartonella* spp. Forty-one blood and 9 flea samples were obtained from cats in three animal shelters in Selangor and Putrajaya, Malaysia. The blood and flea samples were subjected to DNA extraction followed by polymerase chain reaction (PCR) targeting the internal transcribed spacer of the *Bartonella* spp. The analyses detected *Bartonella* spp. in 7.3% (3/41) of cats and 11.1% (1/11) of flea samples. The DNA sequencing using the BLAST Sequence Analysis Tool identified *Bartonella henselae* and *Bartonella clarridgeiae* in the blood and flea sample, respectively. It is speculated that effective ectoparasite control could be the cause of low detection of *Bartonella* spp. in these animal shelters. This is a first study reporting the occurrence of *Bartonella* spp. in shelter cats in Malaysia.

**Keywords:** *Bartonella*, flea, cats, shelters

## HISTOPATHOLOGICAL EVALUATION OF ALCOHOL AND HIGH CHOLESTEROL DIET-INDUCED HEPATIC LIPIDOSIS IN RATS ON *MORINGA OLEIFERA* HYDROETHANOLIC LEAF EXTRACT-SUPPLEMENTED DIET

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### ABSTRACT

*Moringa oleifera* (drumstick tree) is a well-known tropical and subtropical medicinal herb. The herb contains anti-oxidant, anti-inflammatory, anti-cancer and hepatoprotective properties and is reported to reduce high cholesterol levels in blood. Fatty liver is commonly observed in human with excessive alcohol intake and obesity. In animals, particularly cats, fatty liver occurs after prolonged anorexia. This study determined the histopathology of and hepatoprotective effects of *M. oleifera* hydroethanolic leaf extract on alcohol and high cholesterol diet-induced rat hepatic lipidosis. Twenty-five rats were randomly divided into 5 groups; control, alcohol and high cholesterol diet, alcohol and high cholesterol supplemented with either low, medium, or high dose *M. oleifera* extract. After 27 days of experimentation, the livers were weighed, examined histopathologically, and lesions scored. The relative liver weight of rats with hepatic lipidosis and treated with dietary *M. oleifera* extract were significantly lower ( $p < 0.05$ ) in those not treated. Histopathological evaluation showed that among groups, nontreated rats hepatic lipidosis had the highest steatohepatitis score at  $5.25 \pm 0.2$ , followed by rats with hepatic lipidosis treated with low dose dietary *M. oleifera* extract at  $4.00 \pm 0.3$ . Rats with hepatic lipidosis treated with medium dose dietary *M. oleifera* showed borderline steatohepatitis while those treated with high dose did not show significant steatohepatitis. In conclusion, high dose dietary *M. oleifera* hydroethanolic leaf extract supplementation is hepatoprotective in rats with alcohol and high cholesterol diet-induced hepatic lipidosis.

**Keywords:** hepatic lipidosis, relative liver weight, steatohepatitis, *Moringa oleifera* extract

## **SEROPREVALENCE OF ORF VIRUS INFECTION AMONG GOATS FROM SELECTED FARMS IN TERENGGANU, MALAYSIA**

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### **ABSTRACT**

Contagious ecthyma is an infectious disease caused by orf virus, a double-stranded DNA virus of the genus Parapoxvirus. Goats can be infected by the virus that often causes scabby lesions on the skin and adversely affects animal productivity. Information on the status of orf virus infection in Malaysia is inadequate, since previous studies only focused on cases in the state of Selangor, Malaysia. This study determined the rate of seroprevalence of orf virus infection among goats in 11 selected farms in Terengganu, Malaysia. The history of orf virus infection in the goat farms was recorded. Serum samples were collected from 180 goats and stored at -30°C before subjecting to qualitative enzyme-linked immunosorbent assay (ELISA) to determine IgG antibody concentrations. The results showed that 20/180 (11.11%) goats were positive for orf IgG antibodies. The history of orf virus infection is significantly associated with the IgG antibody seropositivity in the goats. In conclusion, orf virus infection is present in goat populations in Terengganu, Malaysia and good herd health programmes should be in place to develop orf awareness among farmers.

**Keywords:** contagious ecthyma, orf, seroprevalence, ELISA, risk factors

## **RETROSPECTIVE STUDY ON FELINE SPOROTRICHOSIS AT THE UNIVERSITY VETERINARY HOSPITAL, UNIVERSITY PUTRA MALAYSIA**

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### **ABSTRACT**

Sporotrichosis a chronic, granulomatous cutaneous mycosis commonly reported in domestic cats and humans is caused by dimorphic fungi *Sporothrix schenckii*. The objectives of this study were to retrospectively determine the prevalence, clinical characteristics, treatment outcomes and prognostic factors of cats diagnosed with sporotrichosis at the Universiti Veterinary Hospital (UVH), Universiti Putra Malaysia. Medical records of cats diagnosed with sporotrichosis from year 2008 to 2017 were extracted, reviewed and analysed. Chi-Square, Mantel Cox Regression and Kaplan-Meier estimator were used for statistical analysis. The median age was 2 years with intact male (75%), Domestic Shorthair breed (87%), free roamers (81%), and cats from multi-cat household (93%) being overrepresented. Ulcerated (poor healing wounds) were the predominant lesion (64%) with common distribution sites that included forelimbs (18%), nose (16%), hindlimbs (15%), and ears (12%). A total of 95% of cats that were on oral itraconazole therapy (10 mg/kg body weight daily) achieved a median clinical cure of 8 weeks. Among the cats treated with itraconazole whereby duration of follow-up was available (32%), the presence of respiratory signs was inversely associated with survival outcome ( $p=0.162$ ). The presence of other concurrent clinical signs during the treatment period resulted in a poorer clinical outcome ( $p=0.012$ ) and cats treated with antifungal concurrent with antibiotics had significantly better clinical outcome ( $p=0.014$ ). On Cox regression analysis, presence of other clinical signs and cats treated with antifungal concurrent with antibiotics were found to be independent prognosticators. In conclusion, feline sporotrichosis is a highly prevalent disease among cats and this study revealed that the presence of concurrent illnesses resulted in poor outcomes. Good outcomes can be facilitated with the addition of antibiotics concurrent with antifungal therapy.

**Keywords:** cat, *Sporothrix*, wound, University Veterinary Hospital, Universiti Putra Malaysia

## **ANTIOXIDANT EFFECTS OF *MORINGA OLEIFERA* LEAF EXTRACT ON RATS FED HIGH CHOLESTEROL DIET AND ALCOHOL**

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### **ABSTRACT**

*Moringa oleifera*, commonly known as drumstick tree, is a well-known in herbal medicinal compound because of its antioxidant and bioactive compounds. Antioxidants refer to substances that inhibit oxidative stress especially in diseases. In this study, the antioxidant effects of *M. oleifera* leaf extract were determined on rats fed high cholesterol and alcohol diet. A total of 25 rats were equally divided into 5 groups; control, high cholesterol and alcohol diet, high cholesterol and alcohol diet and daily treated orally with either low, medium, or high doses of *M. oleifera* leaf extract. The experiment was conducted for 27 days. Serum and liver samples were collected from the sacrificed rats. The concentration of malondialdehyde (MDA) and activities of glutathione peroxidase (GPx) and superoxide dismutase (SOD) were determined on the serum samples and liver tissue homogenates. All treatment had significantly lower ( $p < 0.05$ ) serum MDA concentrations than the nontreatment rats on high cholesterol and alcohol diet. The level of liver MDA in rats on low doses of *M. oleifera* leaf extract was low and comparable with that of the control. The liver tissue GPx levels in treated, although did not differ with the control, were significantly higher ( $p < 0.05$ ) than in nontreated rats on high cholesterol and alcohol diet. The liver SOD level in treated and nontreated rat on high cholesterol and alcohol diet did not differ among groups, but all were significantly lower ( $p < 0.05$ ) than in the control. In conclusion, in rats on high cholesterol and alcohol diet, dietary *M. oleifera* leaf extract enhances liver GPx level and reduced blood MDA concentration.

**Keywords:** *Moringa oleifera*, antioxidant, malondialdehyde, hepatoprotective drugs, cholesterol, alcohol

## **LEPTOSPIROSIS AWARENESS AMONG WORKING DOG HANDLERS IN MALAYSIA**

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### **ABSTRACT**

Leptospirosis is a worldwide zoonotic disease. Occupations with constant contact with animals such as the working dog handlers are at high risk of exposure to leptospirosis. The purpose of this study was to determine the level of knowledge and awareness towards leptospirosis among working dog handlers, effectiveness of the awareness (intervention) programme, and level of preventive practices towards leptospirosis among working dog handlers. A total of 128 working dog handlers (respondents) were recruited in this educational awareness (intervention) programme. A validated questionnaire was distributed prior to and after the intervention. Data such as demographic characteristic, level of knowledge and awareness towards leptospirosis, ability to identify clinical signs associated with leptospirosis, and level of preventive practices towards leptospirosis were obtained. Data collected were tested for normality and subjected to descriptive analysis and statistical analysis. The majority of the respondents (n=128) had knowledge (57%; n=73/128) and showed awareness (50%; n=64/128) towards leptospirosis. The level of knowledge, awareness, and ability to identify clinical signs of leptospirosis increased significantly (p=0.001) with intervention. Respondents have sufficient preventive practice but their attitude towards preventive practices was unsatisfactory. Approximately 53% of respondents did not always use appropriate personal protective equipment during work.

**Keywords:** leptospirosis, knowledge, awareness, preventive practice, working dog handlers, awareness intervention



**EPIDEMIOLOGICAL STUDY OF *MYCOPLASMA GALLISEPTICUM* AND  
*MYCOPLASMA SYNOVIAE* CASES FROM LABORATORIES IN  
MALAYSIA FROM 2012- 2017**

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**ABSTRACT**

*Mycoplasma gallisepticum* (MG) and *Mycoplasma synoviae* (MS) are ubiquitous in major poultry producing countries. Both organisms can cause a wide range of complications especially respiratory and joint problems that lead to significant economic losses to the poultry industry such as production losses, mortalities, condemnations and cost of medications. In this study, the objective was to analyse the epidemiology of MG and MS cases from data of four diagnostic laboratories in Malaysia. Bacteriology, serology and molecular detection data from samples submitted to these laboratories from 2012 to 2017 were collected. Results were analysed for laboratory tests, time trends, geographical distribution, age group and purpose of flock. In total, 54863 samples were submitted to the laboratories for analysis during the period of this period. The rate of isolation of *Mycoplasma sp.* via bacterial culture isolation was 7.5% of samples collected. Meanwhile, MG and MS data showed that 54 and 28% were detected via serology and 28 and 37% via PCR tests, respectively. MG and MS increased throughout the 6 years, and more often involved older age flock. The high rate of *Mycoplasma* infections in poultry flocks in Malaysia warrants the introduction of improved strategies for their control and prevention.

**Keywords:** *Mycoplasma gallisepticum*, *Mycoplasma synoviae*, poultry, epidemiology, serology

**COMPUTED TOMOGRAPHIC EVALUATION OF CHRONIC  
NASAL DISEASES IN DOGS AND CATS AT  
UNIVERSITY VETERINARY HOSPITAL,  
UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

Diseases of the upper respiratory tract are frequently encountered in companion animal practice and represent a diagnostic and management challenge. In Malaysia, there is lack of documentation on correlation between computed tomographic (CT) findings and the final diagnosis in the context of infectious and non-infectious aetiology in chronic nasal disease. A retrospective study was conducted to determine the correlation between CT findings with the final diagnosis in dogs and cats with chronic nasal disease presented to University Veterinary Hospital, Universiti Putra Malaysia from year 2014 to 2017. All dogs and cats with computed tomographic (CT) images, and subsequent bacterial and fungal culture, cytology, and/or histology diagnosis were included in this study. A total of 11 dogs and 17 cats met the inclusion criteria. Computed tomographic features such as nasal laterality, nasal septal change, cribriform destruction, turbinate destruction, sinus involvement, bony changes, extrasinonasal involvement and lymph nodes involvement were evaluated. Among the 11 dogs, 3 were diagnosed with infectious aetiology, which were bacterial (n=2), and fungal rhinitis (n=1) while the remaining 8 were diagnosed with non-infectious aetiology such as neoplasia (n=6), inflammatory rhinitis (n=1), and periodontal disease (n=1). The correlation between CT findings and final diagnosis was found to be not significant ( $p>0.05$ ). Cribriform destruction was the only parameter that was statistically correlated ( $p=0.011$ ) with the final diagnosis of infectious aetiology. For 17 cats with chronic nasal disease, 9 were diagnosed with infectious aetiology, which were bacterial rhinitis (n=9) while the remaining 8 were non-infectious including neoplasia, (n=6), inflammatory rhinitis (n=1), and trauma (n=1). In cats, bony changes of the nasal cavity was found significantly correlated ( $p<0.05$ ) with infectious aetiology. There is need for more cases to obtain more reliable and accurate results. In conclusion, CT is superior for the detection of changes in the nasal cavity, determination of extent and severity of the disease; however, it is not sensitive in differentiating between infectious and non-infectious aetiology and the establishment of accurate and definitive diagnoses.

**Keywords:** computed tomography, chronic nasal disease, rhinitis, nasal flush, nasal biopsy.

## **CADAVERINE AND PUTRESCINE AS DETERMINANTS OF POULTRY POST-MORTEM INTERVAL AND CARCASS FRESHNESS**

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### **ABSTRACT**

Gauging the freshness of a chicken carcass has always been a subjectively reliant upon organoleptics and stipulated expiry date. This study evaluates the potential role of biogenic amines, namely cadaverine and putrescine as freshness indicators of poultry post-mortem interval (PMI) and freshness. Six live chickens procured from a retailer were immediately slaughtered upon arrival. Then, the temperature changes and liver and muscle samples were obtained at 0, 6, 12, 18, and 24 hours post-slaughter. The tissues were fixed immediately in 10% buffered formalin prior to routine processing and stained with hematoxylin and eosin (H&E) and immunohistochemically (IHC) for cadaverine and putrescine. Both H&E and IHC stained samples were subjected to analysis and scored. The carcass cooling rate as an indicator of PMI showed a decreasing pattern with time. Both hepatic and muscular cadaverine and putrescine expressions increased significantly ( $p < 0.007$ ) with time. The interaction between liver cadaverine and putrescine expression and duration of PMI were significantly positive ( $p < 0.003$ ). In conclusion, cooling rate is not a good indicator for poultry carcass PMI; however, both liver and muscle cadaverine and putrescine expressions are suitable indicators for poultry carcass freshness for the 18-hour period.

**Keywords:** freshness, biogenic amines, immunohistochemistry, putrescine, cadaverine

## **EFFECT OF *MORINGA OLEIFERA* HYDROETHANOLIC LEAF EXTRACT ON SERUM LIPID PROFILE IN HYPERCHOLESTEROLAEMIC RATS**

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### **ABSTRACT**

*Moringa oleifera* Lam, (*Moringa pterygosperma*) also known as ‘drumstick tree’ and ‘horse radish tree’ in India or ‘kelor tree’ in some part of the world, is a plant that is used in several traditional medicinal and nutritional applications. However, there is little information available on the anti-hypercholesterolaemic activity of *M. oleifera* hydroethanolic leaf extract. In this study, the effect of *M. oleifera* leaf extract on alcohol and high-cholesterol diet-induced hypercholesterolaemia rats was determined. A total of 25 male Sprague-Dawley rats were randomly divided equally into 5 groups; Group A as a neutral control received normal commercial diet, group B as a negative control, received alcohol and high cholesterol diet without treatment, groups C, D, and E as the treatment group, received alcohol and high cholesterol diet, concurrent with the *M. oleifera* hydroethanolic extract at the low, medium and high dose, respectively. At the end of the experiment, blood and liver were collected to measure the serum and liver lipid profile. Liver lipid extraction was done following an adaptation of the published Bligh and Dyer method. Result showed that the relative liver weight of group B (4.11±0.35) was significantly higher compared to group A (3.32±0.46), confirming the negative effect of the alcohol and high cholesterol diet experiment. The 27 days of treatment also significantly reduced kidney fat of groups C and D, compared to group B. The serum low density lipoprotein (LDL) levels of groups C (0.94±0.17), D (0.65±0.41), E (1.04±0.52) were significantly ( $p<0.05$ ) lower compared to group B (1.25±0.05). The extract also significantly ( $p<0.05$ ) reduced the atherosclerotic index induced by alcohol and high cholesterol diet as seen in groups C (0.27±0.04), D (0.30±0.06), E (0.36±0.07) as compared to group B (0.41±0.02). However, there was no significant dose effect observed between the treatment groups of different dosages. In conclusion, administration of *M. oleifera* hydroethanolic extract for 27 days significantly reduced hepatomegaly by decreasing hepatic triglyceride, reduced renal fat, serum LDL and atherosclerotic index. The results suggest that *M. oleifera* hydroethanolic extract has hepatic-protective properties in hypercholesterolaemic rats.

**Keywords:** *Moringa oleifera*, LDL, atherosclerotic index, hypercholesterolaemic rat

**PREVALENCE OF CANINE FILARIASIS AMONG  
STRAY POPULATION IN AN INDIGENOUS VILLAGE  
IN ROYAL BELUM, PERAK, MALAYSIA**

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**ABSTRACT**

Canine filariasis is gaining importance worldwide due to its zoonotic potential and public health significance. *Dirofilaria* spp., *Acanthocheilonema* spp. and *Brugia* spp. have been reported in dogs in Malaysia. The climatic conditions in Malaysia is favourable climate for survival and propagation; however, information concerning the prevalence of canine filariasis in the country is limited. Hence, this study was conducted to investigate the prevalence of canine filariasis in an indigenous village in Royal Belum, Perak, Malaysia. Anticoagulated blood samples were collected from 37 dogs comprising of 29 males and 8 females. The blood samples were subjected to the single step multiplex polymerase chain reaction (PCR) targeting and amplifying the internal transcribed spacer-2 (ITS-2) region of extracted DNA, to determine the presence of filariasis. Only *Dirofilaria immitis* was detected and the prevalence of canine dirofilariasis was 62.2% (23/37). Among the infected dogs, 20 were males and 3 females. The presence of vector and the high density of stray dog population are the contributing factors to the prevalence of dirofilariasis in the Royal Belum area.

**Keywords:** prevalence, canine filariasis, zoonotic, public health, polymerase chain reaction

## **BLOOD PROFILE OF GOATS ON SOY WASTE-SUPPLEMENTED DIET**

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### **ABSTRACT**

Agricultural by-products have great potential as animal feed. Among these by-products, soy waste is extensively being included in the diets of goats. Currently, studies on the effect of soy waste dietary supplementation on the health and performance of goats are limited. In this study, the effect of soy waste dietary supplementation on nutrition-related blood profile in breeder goats was determined. Eighteen female Boer-cross adult goats were divided into three equal dietary groups; control (no supplementation), SW 10 (supplemented with 10% soy waste), and SW 20 (supplemented with 20% soy waste). Blood samples were obtained before and after 3 weeks of soy waste supplementation and their calcium, total protein, glucose, cholesterol, and fatty acid concentrations determined. The serum glucose, total protein, calcium, and cholesterol concentrations of the SW 10 and SW 20 goats were higher than the control. Proximate analysis of soy waste-supplemented feed showed the content of crude protein content was lower and crude fibre and dry matter higher in soy waste supplemented than non-supplemented feed. The content of unsaturated fatty acid was significantly higher ( $p < 0.05$ ) than saturated in feed and serum of soy waste-supplemented groups than in the control. Thus, this study showed that soy waste dietary supplementation affects certain nutrition-related blood profile in goats.

**Keywords:** breeder goats, blood profile, proximate analysis, fatty acid

**OCCURRENCE OF GASTROINTESTINAL PARASITE INFECTION  
IN *PUMA CONCOLOR*, *PANTHERA LEO*, *PANTHERA PARDUS*, AND  
*PANTHERA ONCA* AT THE NATIONAL ZOO, MALAYSIA**

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**ABSTRACT**

Wild animals have very low genetic resistance towards parasitic infection mainly due to the lack of exposure to parasites. However, in captivity or zoological gardens, parasitic infections may pose serious threats to the endangered species. The present study was conducted to determine the occurrence of gastrointestinal parasites in large felids at the National Zoo of Malaysia for a period of 2 weeks in January, 2018. Ten faecal samples were collected from pumas (*Puma concolor*, n=5), African lions (*Panthera leo*, n=4), spotted leopard (*Panthera pardus*, n=1) and black panther (*Panthera onca*, n=1) in the morning, and transported in an ice-box the Parasitology Laboratory, Faculty of Veterinary Medicine, Universiti Putra Malaysia for analyses. All samples were examined for parasite eggs, larvae and oocysts by simple floatation technique using the salt solution and formalin-ether sedimentation technique. All large felids in Zoo Negara were infected with gastrointestinal parasites, mainly nematodes. Six species of gastrointestinal parasites recovered included 4 nematodes (*Toxocara cati*, *Ancylostoma* spp., *Toxascaris leonina*, and *Oxyuris* spp.) and one each of cestode (*Spirometra* spp.) and protozoa (unknown). Most large felids had mixed *Toxocara* spp. and *Ancylostoma* spp. infections.

**Keywords:** large felines, National Zoo Malaysia, gastrointestinal parasites, formalin-ether sedimentation, simple floatation

## **MORPHOLOGICAL COMPARISON OF DEAD SALTWATER CROCODILE (*CROCODYLUS POROSUS*) HATCHLINGS BETWEEN NATURAL NEST AND ARTIFICIAL INCUBATOR**

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### **ABSTRACT**

Crocodile rearing and farming could be a means for their preservation. In order for crocodile farming to thrive, there is a need for continuous supply of healthy hatchlings. Incubation methods play a huge role in ensuring fitness and survival rate of hatchlings and to produce healthy and quality of crocodiles. The hatchling success rate of Saltwater crocodile (*Crocodylus porosus*) vary with method of incubation. Currently, there is little information on the development of hatchling from these incubation methods. Therefore, the purpose of this study is to compare the morphology of hatchlings derived from natural nest and artificial incubators. Nineteen dead hatchlings of the Estuarian crocodile from various clutches were used in this study. The morphometric measurements showed that hatchlings from artificial incubation showed better traits, including longer tail and larger heads than those from natural nests.

**Keywords:** morphological analysis, *Crocodylus porosus*, natural nest and artificial incubator comparison



## **DETERMINATION OF CHOLESTEROL STORAGE IN HEPG2 CELLS SUPPLEMENTED WITH EXOGENOUS CHOLESTEROL AND EDIBLE BIRD'S NEST EXTRACT**

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### **ABSTRACT**

Edible bird's nest (EBN) primarily made of glycoproteins are produced by swiftlet birds (*Aerodramus* spp.) during the breeding season. It is widely used as food supplement and it is believed to have high medicinal values in traditional Chinese medicine. The aim of this study is to determine the anti-cholesterol effect of EBN extracts by evaluating the amount of cholesterol being stored inside the HepG2 cells. The amount of cholesterol being stored inside HepG2 cells was quantified using enzyme-linked immunosorbent assay. In addition, the expression of LDL receptors was assessed via immunofluorescent staining microscopy. Results show that cells supplemented with EBN extracts increased the amount of cholesterol stored intracellularly in the lipid droplets. Findings from this study suggest that EBN has the anti-cholesterol effects almost similar to statin drugs.

**Keywords:** edible bird's nests, swiftlet (*Aerodramus* spp.), HepG2 cells, cholesterol, lipid droplets

**CLINICAL COMPARISON BETWEEN EXPERIMENTAL  
*STREPTOCOCCUS AGALACTIAE* AND *STREPTOCOCCUS INIAE* INFECTIONS  
IN *OREOCHROMIS* SP.**

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**ABSTRACT**

Streptococcosis is an infection by Gram-positive bacteria of the genus *Streptococcus*. Currently, *Streptococcus agalactiae* and *Streptococcus iniae* have been identified as the main pathogens causing streptococcosis, leading to severe economic losses in the aquaculture industry throughout the world. This study was conducted to compare the severity of the clinical signs, occurrence of transmission, and mortality of *Oreochromis sp.* following exposure to *S. agalactiae* (*Streptococcus agalactiae*) or *S. iniae* (*Streptococcus iniae*) via intraperitoneal infection. Two experiments were conducted. In the first experiment, 60 healthy *Oreochromis sp.* with the size of less than 101.6 m were divided equally into three (3) groups; one control (G1) (n=20) and two treatment groups (G2, G3) (n=20) each. Each group was further divided equally into two groups, consisting of 10 inoculated fish and 10 fish were not inoculated but served as commingling fish. The control group was inoculated with sterile PBS while reaments groups were inoculated with  $1 \times 10^7$  cfu/mL of *S. agalactiae*, and *S. iniae*, intraperitoneally, respively at the rate of 0.03 mL/g. In the second experiment, the same experimental design was used, with the exception of the size of fish. Fish with more than 101.6 m were used in which G4 was inoculated with sterile PBS, G5 was inoculated with *S. agalactiae* and G6 was inoculated with *S. iniae* at the aforementioned rate. All fish were observed every 6 hours for a period of 5 days. All clinical signs exhibited and death were recorded and scored. After day 5 post inoculation, any survived fish were euthanised. The affected fish showed clinical signs such as inappetence, lethargy, corneal opacity, fin haemorrhages, erratic swimming, dyspnoea and exophthalmos. Comingled fish of G2, G3, G5, and G6 showed the same clinical signs and death, suggesting transmission from their respective inoculated fish. In less than and more than 101.6 m fish, the inoculated G2 and G5 showed significantly ( $p < 0.05$ ) higher clinical sign score compared to the comingled G3 and G6. The highest mortality rate was observed in the inoculated G5 (50%), followed by the inoculated G2 (30%). No death was observed in control groups. *S. agalactiae* was observed to be more pathogenic than *S. iniae* in *Oreochromis sp.*, and fish more than 4" is more susceptible towards both streptococcosis.

**Keywords:** Streptococcosis, *Streptococcus agalactiae*, *Streptococcus iniae*, clinical sign, mortality, *Oreochromis sp.*

## **EFFICACY OF INCORPORATED AND TOP-DRESSED FEED VACCINES AGAINST *STREPTOCOCCUS INIAE* INFECTION IN RED HYBRID TILAPIA (*OREOCHROMIS* SP.) FINGERLINGS**

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### **ABSTRACT**

Intensification of tilapia farming to achieve higher productivity has resulted in increased susceptibility of the fish to diseases. Streptococcosis is one of disease of concern in aquaculture because it can high economic losses. Vaccination is the ideal method to prevent outbreak of the disease. Although economical, the effectiveness oral vaccine is still questionable. This study determined the efficacy of incorporated and top-dressed feed formalin-killed bacterin vaccines against *Streptococcus iniae* infection in Red Hybrid Tilapia fingerlings. Two hundred and forty fingerlings were divided equally into 3 Groups; group 1 was vaccinated with incorporated-feed vaccine, group was vaccinated with top-dressed feed vaccine, and Group 3 served as the control. Serum, body mucus, and gut lavage from each group collected weekly for 7 weeks were subjected to indirect-ELISA to determine IgM antibody titre. All fish were challenged in week 4 and the protective capability of the vaccines observed for 14 days post-challenge. The results showed that vaccinated had significantly higher ( $p < 0.05$ ) IgM antibody titre than the unvaccinated fish. Based on clinical signs of streptococcosis, the vaccinated fish showed better protective immunity following bacterial challenge than unvaccinated fish. In conclusion, although oral vaccination with feed-based vaccine confers protective immunity, its effectiveness can be improved.

**Keywords:** tilapia, *Streptococcus iniae*, formalin-killed bacterin, incorporated feed vaccine, top-dressed feed vaccine, indirect-ELISA

## **EXTRACTION AND CHARACTERISATION OF GELATINE FROM RABBIT (*ORYCTOLAGUS CUNICULUS*) BONE**

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### **ABSTRACT**

Gelatine is a mixture of protein and peptides made through partial hydrolysis of animal skin, bone, or connective tissue collagen. Gelatine is now widely used in food, photography, cosmetics, and pharmaceuticals. The current sources of gelatine are mainly pigs and cattle and production of gelatine from these source have religious issues among muslims. In addition, since these animals can potentially transmit infectious diseases to humans, an alternative source of gelatine is urgently needed. Thus, this study was conducted to develop an alternative source of gelatine by using rabbit bones. Gelatine was extracted from 10 fresh rabbit bones and the purity, yield percentage and gelling and melting temperature determined. The gelatine yields from the rabbit bones were between 3.56 to 7.27%, averaging at 5.4%. The time taken for gelling of gelatine at room temperature, 4, and -20°C were >72 h, 20, and 5 min, respectively. Melting of gelatine at 25, 30, 35, and 40 °C took 6, 4, 3, and 1 min, respectively. Using SDS-PAGE, the peptide profile showed 11 major bands of size ranging from 10 to 100 kDa with predominant bands at approximately 80, 55, and 25 kDa. It is concluded that with improvements on extraction and filtration methods, gelatine from rabbit can be developed as a good, religiously acceptable, and commercially viable product.

**Keywords:** gelatine, rabbit bone, purity, yield percentage, gelling and melting temperature

## **PROTEIN EXTRACTION METHODS FROM EDIBLE BIRD'S NEST SAMPLES**

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### **ABSTRACT**

Rich in its nutritional elements, edible bird's nest (EBN) has become one of the most expensive natural products. The EBN contains two major constituents, carbohydrates and proteins, and with unusual abundance of glycoproteins. With proteomic analysis, the identification of low abundance proteins will uncover the secret of EBN benefits. The objectives of this study were to compare crude protein yields from EBN using four protein extraction methods and determine the difference in yield between farmed and commercial EBN samples. Protein extractions were performed using aqueous extraction at 70°C and 100°C (with or without acetone precipitation method) as well as sodium dodecyl sulfate and Triton X-100 before protein quantification. Both EBN samples yielded highest protein concentration with aqueous extraction at 100°C with acetone precipitation. Triton X-100 extraction yielded the least amount of protein from both EBN samples. The study showed that the best method of protein extraction from EBN is with the use of aqueous extraction at 100°C with acetone precipitation method.

**Keywords:** edible bird's nest (EBN), protein extraction method, detergent-based, acetone precipitation, water extraction

**SURVEY ON THE AWARENESS OF ZONOTIC DISEASES  
AMONG PRIMARY SCHOOL STUDENTS OF  
SEKOLAH KEBANGSAAN AGAMA,  
BINTULU, SARAWAK, MALAYSIA**

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**ABSTRACT**

Zoonotic disease is a very serious and dangerous disease. Zoonotic disease can be addressed through early action plan implemented by animal and public health authorities. Education-based awareness campaigns are particularly important in rural areas to minimise occurrence of zoonotic diseases. This study was conducted to determine the effect of a zoonotic disease awareness programme on 39 students of Sekolah Kebangsaan Agama, Majlis Islam Sarawak, Bintulu, Sarawak. The awareness programme was conducted at the school in 2 phases for 2 days on 10th and 11th July 2017. This awareness programme comprised of 8 modules consisting of interactive activities, lectures, and visits to local dairy farms. A questionnaire 36 questions and 11 sub-question on the general knowledge of zoonotic diseases was presented to the students before and after the awareness programme. The data were analysed using the Wilcoxon Signed Rank method to assess the level of awareness and knowledge of the students on zoonotic disease. This study revealed that only a small number of students of Sekolah Kebangsaan Agama, Majlis Islam Sarawak acquired additional knowledge on the awareness of zoonotic diseases after undergoing the awareness programme. The majority of students already had high level of awareness on the zoonotic diseases even before the participating in the programme. It is believed that rabies outbreaks in Sarawak had triggered public and government authorities to distribute zoonotic disease outbreak manuals that was also accessible to the students of the school.

**Keywords:** zoonotic disease, primary school student, awareness program, outbreak, questionnaire

## **IDENTIFICATION OF BOVINE GROWTH HORMONE GENE POLYMORPHISM IN BUFFALO BULLS USING THE PCR-RFLP METHOD**

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### **ABSTRACT**

Growth hormone (GH) is a single polypeptide protein chain hormone that is synthesised and secreted from anterior pituitary by somatotroph cells. The GH gene hastens metabolism and promote growth of many organs and tissues, especially the bone, muscle, and visceral organs and regulates growth, lactation and mammary gland development. The purpose of this study was to determine the presence of bovine growth hormone (bGH) gene polymorphisms in buffalo bulls (*Bubalus bubalis*) using polymerase chain reaction-restriction fragment length polymorphism (PCR-RFLP) technique. Ten blood samples from crossbred Murrah and Swamp buffaloes were subjected to extraction to collect whole DNA genome. The DNA genome was amplified using GH2 primers designed using the cattle GH gene sequences. The DNA quality was determined by running the samples on 2% agarose gel electrophoresis. Polymerase chain reaction was used to amplify the GH fragments. The DNA amplified fragments of GH gene were at 436 bp with GH2 forward (5'-CGG ACC GTG TCT ATG AGA AGC TGA AG-3') and reverse (5'-GTT CTT GAG CAG CGC GTC GTC A-3') primer sequences. The DNA was digested with *AluI* endonuclease restriction enzyme and through PCR-RFLP produced the same size of bands that gave two digested fragments at 295 and 100 bp. The result showed that there is no polymorphisms in the genes the buffalo bulls.

**Keywords:** buffalo bulls, growth hormone gene, bovine growth hormone (bGH), PCR-RFLP, polymorphism

## MOLECULAR DETECTION AND PHYLOGENETIC ANALYSIS OF ORF VIRUSES FROM SELECTED GOAT FARM IN TERENGGANU, MALAYSIA

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### ABSTRACT

Orf virus (ORFV) is the prototype species of the genus *Parapoxvirus* belonging to the family of Poxviridae causing contagious ecthyma. Orf virus can cause acute pustular lesion in the skin of goat, sheep, and wild ruminants. This study determined the status of contagious ecthyma in the selected farms in Terengganu, Malaysia. Eleven goat farms were screened for contagious ecthyma based on clinical signs and gross lesions. Skin scrapping samples were taken from 4 infected animals and analysed using PCR targeting B2L and VIR genes using ORFV specific primers. All samples were positive for ORFV based on the band sizes. Positive samples were sent for sequencing for further confirmation. The DNA sequences were aligned and verified by using BLAST software. Phylogenetic analysis was carried out based on conserved regions of the genes (B2L and VIR) by using MEGA7 software. The B2L phylogenetic analysis showed that the ORFV samples had high homology with the selected ORFV isolates from a goat farm in Selangor, Malaysia. The ORFV Terengganu isolates were also closely related with the ORFV isolates from India and China. In the VIR phylogenetic analysis, all 4 samples showed high homology to the Brazilian ORFV isolate and previous Malaysian isolates. There was genetic variability among the ORFV isolates in this study. Therefore, future vaccination programmes must consider the potential of immunogenicity and cross-protection among different ORFV isolates.

**Keywords:** orf virus, contagious ecthyma, molecular detection, phylogenetic analysis



## **MICROBIOLOGICAL QUALITY OF WASHED AND UNWASHED EGGS STORED CHILLED AND AT ROOM TEMPERATURE**

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### **ABSTRACT**

Egg contamination can occur in various ways such as during laying, collection, grading, packaging, transportation, storage, and at the retailers. The study determined the microbiological quality of washed and unwashed eggs stored chilled and at room temperature. A total of 32 chicken eggs from four brands were bought from supermarkets. Each brand consisted of eight egg samples. The brands were chosen based on the price, from cheap to expensive. Eggs from each brand was divided into two groups of 4 eggs per group. Four eggs were not washed. The other four eggs were washed using running tap water as usually practiced by the consumers. The 4 eggs in each group were further divided into 2 sub-groups of two eggs each. Two of the eggs were stored at chilled temperature (10 °C) and 2 kept at room temperature (27 °C). The microbiological quality of the eggs was determined using the Standard Plate Count (SPC) and Coliform Plate Count (CPC). The SPC of unwashed eggs at day 0 ranged from 27 to 97 × 10<sup>2</sup> cfu/mL (mean: 61 × 10<sup>2</sup> cfu/mL) and the CPC was less < 1 × 10 cfu/mL. For washed eggs, the SPC at day 0 ranged from 26 to 66 × 10 cfu/mL (mean: 46 × 10 cfu/mL) and the CPC was < 1 × 10 cfu/mL. After 5 days, the mean SPC of washed eggs stored at chilled temperature was 70 × 10 cfu/mL which was 32% higher than that at day 0 while the CPC remained at < 1 × 10 cfu/mL. The mean SPC of washed eggs stored at room temperature was 10 × 10<sup>2</sup> cfu/mL which was 41% higher than that at day 0 while the CPC was also < 1 × 10 cfu/mL. The mean SPC of unwashed eggs stored at chilled temperature was 87 × 10<sup>2</sup> cfu/mL which was 18% higher than at day 0 and the CPC remained at < 1 × 10<sup>3</sup> cfu/mL. The mean SPC of unwashed eggs stored at room temperature was 16 × 10<sup>3</sup> cfu/mL which was 44% higher than at day 0 while the CPC remained at < 1 × 10 cfu/mL. In conclusion, the better way to store eggs is by washing the eggs and store at chilled temperature (10°C).

**Keywords:** eggs, washed, unwashed, Standard Plate Count, Coliform Plate Count, chilled, temperature

**RETROSPECTIVE STUDY ON THE EFFECT OF SEASONAL CHANGES AND TEMPERATURE-HUMIDITY INDEX ON DAIRY COW MILK PRODUCTION IN THE AGRICULTURE PARK, UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

In Malaysia, the temperature-humidity index (THI) is expected to be lower during rainy season northeast monsoon (November to April), causing decrease in heat stress and consequently increase in milk production. On the other hand, THI is expected to be higher during dry season southwest monsoon (May to October), causing increase in heat stress and consequently decrease in milk production. This study determined the effects of seasonal changes and temperature-humidity index on dairy cow milk production at the Agriculture Park, Universiti Putra Malaysia. Monthly weather data from year 2013 to 2017 were used to calculate THI based on average monthly temperature and humidity. The monthly milk yield obtained from farm records were assigned to their respective monthly THI volume. It was found that the total and monthly mean milk yield were higher during northeast monsoon than during southwest monsoon, however the difference was not significant ( $p > 0.05$ ). There was a weak negative correlation ( $r = 0.21$ ,  $R^2 = 0.045$ ;  $p > 0.05$ ) between milk yield and monsoon seasons. Base on this study, it is concluded that the narrow annual THI range and adaptation and acclimation of local cattle to the tropical climate is responsible for the lack of difference in their milk production between seasons.

**Keywords:** dairy cow, milk production, temperature-humidity index, Northeast, Southwest, monsoon,

## **A SURVEY ON FEEDING SYSTEM AND AN ESTIMATION OF NUTRIENT INTAKE BY GOATS IN FOSTER FARMS OF UNIVERSITI PUTRA MALAYSIA**

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### **ABSTRACT**

In Malaysia, the small ruminant industry is still not well developed and mainly operated by smallholder farmers. The feed provided usually consists of native pastures available, supplemented with locally available feedstuff. The farmers lack knowledge on the nutritional content in animal feeds and the amount of nutrient required by the livestock to increase meat and milk production. Due to lack of knowledge, the animals are often fed poor quality pastures that had resulted in inadequate feeding and nutrition, and low animal productivity. Therefore, this investigation determined the type of feed, nutritive value of animal feeds, and animal production stage in the foster farms of Universiti Putra Malaysia. The nutrient intake was estimated based on total mixed ration in relation to production stage. Prior to this, a survey to collect information on feed and feeding practices in 5 goat farms was done by questionnaire, interviews, and observations during farm visits. In general, all farms practiced cut and carry system feeding management but with different types and portions of feed. The estimated nutrient intake among goats in the selected farms fulfilled the total digestible requirement, except for growing animals in 2 Farms. The total protein intake of growing animals in one Farm was below the total protein requirement. The dry matter intake for some animals in 2 farms was less than the required amount. Although the dry matter intake was low, the nutrients feed to the animals were satisfactory.

**Keywords:** livestock, nutrient intake, dry matter, total digestible nutrient, total protein, calcium, phosphorus

## **PATHOLOGICAL CHANGES IN GILLS, LIVER, AND KIDNEYS OF KOI FISH (*CYPRINUS CARPIO*) EXPOSED TO CLOVE OIL USING THE FISH ANAESTHESIA DELIVERY SYSTEM**

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### **ABSTRACT**

Clove oil is a natural and inexpensive anaesthetic agent that is currently being used extensively as an alternative anaesthetic in fish aquaculture industry. This study aimed to evaluate pathological changes in gills, liver and kidney of Koi carp (*Cyprinus carpio*) upon exposure to clove oil using a fish anaesthesia delivery system involving recirculation of anaesthetic clove oil over the gills. A total of 20 Koi fish were divided into 4 equal groups; three groups were placed under surgery simulation for either 5, 15 or 30 min using 50 mg/L clove oil as the anaesthetic agent. The fourth group served as the control group. The gills, kidney and liver samples were obtained from all groups for gross and histopathology evaluation. This study showed that clove oil did not induce histopathological changes in the kidneys or liver. However, the gills showed microscopic changes including epithelial lifting, epithelial cell swelling, oedema, and blood vessel dilatation. Fish exposed for 5 and 15 min exhibited mild whereas those exposed for 30 min showed moderate to severe histopathological changes. The study showed that exposure to clove oil for as long as 15 minutes is safe and can provide optimal anaesthesia, while 30 min of exposure is detrimental to the Koi fish.

**Keywords:** Koi fish, *Cyprinus carpio*, clove oil, anaesthesia, fish anaesthesia delivery system, pathological changes

## **VISUAL BODY CONDITION SCORE EVALUATION OF DAIRY CATTLE IN UNIVERSITI PUTRA MALAYSIA FOSTER FARMS**

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### **ABSTRACT**

Body condition score (BCS) is an important management tool that has been widely used in the assessment of energy status in dairy cattle. It can be used as a guideline to determine the health and performance of the animal. Dairy cattle in Universiti Putra Malaysia foster farms mainly consist of smallholder farms that are semi intensively-managed and may not follow the recommended feeding regime required for the different lactation stages. The aim of this study was to evaluate the general BCS of dairy cows on these farms. A total of 40 cows were randomly selected from 4 farms. The body weights of the cows was determined and BCS evaluation performed using a 1 to 5 rating scale system. The study showed that 37, 30, 23, and 10% of the animals had BCS of 3.0, 3.5, 2.5 and 2.0 respectively. The study also showed that 67% of animals met the recommended BCS, which is suggestive of good feeding management. However, 33% of the animals had poor BCS. Hence, it is recommended that these dairy cattle foster farms improve feeding management to meet the requirements of lactational stages of the animal.

**Keywords:** body condition score, dairy cattle, body weight

## IDENTIFICATION OF HELMINTHS AND ECTOPARASITES IN LABORATORY MICE

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### ABSTRACT

The laboratory mice (*Mus musculus*) are used widely in research. Despite strict biosecurity, it was reported that the skin and intestinal tract of the laboratory mice carry various parasitic species. There is need to improve health quality of laboratory mice for better research outcomes. Thus, the objectives of this study were to determine the presence of helminths and ectoparasites in laboratory mice and to compare the type of helminths among strains and sexes. A total of 24 mice consisted of 6 males and 6 females from each strain, BALB/C and ICR, were obtained from the Animal Resource Unit, Faculty of Veterinary Medicine, Universiti Putra Malaysia. Parasitological methods used for ectoparasite identification were perianal tape test and fur pluck, whereas direct fecal smear, faecal floatation, direct examination of intestine, and carcass immersion in alcohol were performed for helminth identification. The two most common helminths infesting 5 out of 16 mice of the euthanised group were *Syphacia obvelata* and *Aspicularis tetraptera*. However, the samples were negative for ectoparasites and blood protozoa. There were no association between sexes and strains of the mice with the type of helminth infestation. Based on the findings, the laboratory mice at the Animal Resource Unit were free from ectoparasite and blood protozoa, while helminth infestation was low.

**Keywords:** ectoparasites, helminthes, laboratory mice, *Aspicularis tetraptera*, *Syphacia obvelata*

## **MEAT QUALITY AND NUTRITIONAL VALUE OF COMMERCIAL PORK AND WILD BOAR MEAT**

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### **ABSTRACT**

There is growing consumer demand for wild boar meat despite of the well-established swine industry in Malaysia. To ensure consumer satisfaction, there is need to determine the quality of the wild boar meat. Thus, this study aimed to compare the meat quality and nutritional values of commercial pork and wild boar meat obtained from a local market in Selangor, Malaysia. Meat quality on longissimus dorsi was analysed based on ultimate pH, colour, drip loss, cooking loss and shear force and the nutritional value evaluated based on crude protein, crude fat, and fatty acid composition. The study showed that the average ultimate pH for commercial pork and wild boar meat were 5.63 and 6.11, respectively ( $p < 0.05$ ). The wild boar meat was significantly ( $p < 0.05$ ) higher in redness and lower in lightness than commercial pork. The average drip loss was higher in commercial pork compared to wild boar meat ( $p < 0.05$ ). However, the cooking loss and shear force did not differ between meats. Crude fat and fatty acid composition (e.g. linoleic acid, C18:2n) were higher in commercial pork than in wild boar meat. The study showed that the wild boar meat has higher pH value and water holding capacity and is more prone to be dark and firm than commercial pork, which more associated with spoilage, undesirable taste, toughness, and short shelf-life. However, wild boar meats has higher nutritional value and protein content than commercial pork. The fatty acid composition of commercial pork is better than wild boar meat, suggesting that commercial pork has better nutritional value.

**Keywords:** commercial pork, wild boar, longissimus dorsi, meat quality, fatty acid composition

## **CHOOSING A CAT AS A PET: FACTORS INFLUENCING OWNERS' PREFERENCE AND THE LEVEL OF AWARENESS ON RESPONSIBLE PET OWNERSHIP**

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### **ABSTRACT**

The choices made by owners in choosing cats as pets either through adoption or purchase may be influenced by intrinsic and extrinsic factors. The purpose of this study was to elucidate factors influencing owners' preference in choosing cats as pets. Questionnaires were distributed to cat owners consulting several small animal clinics in Selangor, Malaysia. A total of 100 respondents were recruited for the study. Questionnaires consisted of sections including demographic profile and pet ownership information, assessment on an owner's opinion, preferences, and reasons for choosing cats as pets, knowledge on animal shelter, and assessment on the level of awareness of responsible pet ownership. The data were analysed using descriptive statistics and Chi-Square test. The results suggested that each cat owner had a specific set of preferences in choosing cats as pets and had acceptable level of awareness regarding responsible pet ownership. However, owners had average to low levels of awareness on cat-associated zoonotic diseases. A more effective mode of client/owner education regarding responsible pet ownership during the selection of cats for adoption is needed, to avoid abandonment of pet because of pet-owner personality conflicts.

**Keywords:** cats, adoption, preference, zoonotic diseases, awareness



## **INBREEDING COEFFICIENT AND ITS ASSOCIATION WITH SELECTED GROWTH TRAITS OF SWAMP AND MURRAH-CROSS BUFFALOES IN SABAH, MALAYSIA**

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### **ABSTRACT**

Inbreeding has become a common practice in livestock farms and the negative effects of inbreeding on performance of animals are of great concern. This study aimed to measure the inbreeding coefficient level and evaluate its association with birth weight and weaning weight of Swamp and Murrah-cross buffaloes in Sabah, Malaysia. Data on identification number, breed, age of weaning, birth and weaning weight of 50 buffaloes (F2) at Pusat Pembiakan dan Penyelidikan Kerbau, Telupid were collected. Identification numbers of sire, dam (F1) and parent were recorded to determine whether the animals were inbred or outbred. Inbred individuals were then classified into three inbreeding systems, half-sib, full-sib, and parent-offspring mating, and inbreeding coefficients calculated. Birth and weaning weight of each animal was regressed on inbreeding coefficient to determine the effect of inbreeding on these growth parameters. Seventeen of 50 buffaloes were inbred and inbreeding coefficients of Swamp and Murrah-cross buffaloes did not show association with their birth and weaning weight. The findings could be due to the inbreeding coefficients calculated in this study were not high enough to cause inbreeding depression on birth and weaning weights of the animals. The growth parameters could be affected by other factors such as genetic and environment, which may be more influential than the level of inbreeding in these buffaloes.

**Keywords:** inbreeding, inbreeding coefficient, buffalo, growth traits, outbred

**BACTERIAL LOAD IN VARIOUS ORGANS AT DIFFERENT PERIODS AFTER DEATH FOLLOWING INFECTION BY PATHOGENIC *ESCHERICHIA COLI***

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**ABSTRACT**

Post-mortem examinations are not always conducted immediately in the field. The lack of facilities such as refrigerators in certain farms or clinics, may affect post-mortem results. This study was conducted to determine, following infection by a sepsis-causing agent, the bacterial yield and type of isolates in the liver and lungs of animals at different time points after death. Fifteen BALB/c mice were divided randomly into 3 groups of 5 animals per group. The groups was injected with either  $1 \times 10^5$  cfu/mL of live *Escherichia coli*,  $1 \times 10^5$  cfu/mL live *Pasteurella multocida* B:2, or sterile phosphate buffered saline (PBS). At 0, 24 and 48 h after death, the lungs and liver were cultured for bacteria to determine bacterial concentrations. *E. coli* infected mice showed significant ( $p < 0.05$ ) increase in *E. coli* concentration between 0 and 24 h post-mortem that was maintained until 48 h post-mortem. Mice treated infected with *P. multocida* B:2 showed significant ( $p < 0.05$ ) reduction in concentration of *P. multocida* B:2 from 24 and 48 h post-mortem. The percentages of pure isolates of *E. coli* and *P. multocida* B:2 were significantly ( $p < 0.05$ ) higher when sampled immediately than later post-mortem. In conclusion, the bacterial yield and the culture of pure isolates are inversely proportional to the time of sampling after death.

**Keywords:** post-mortem interval, bacterial concentration, sepsis, pure culture, time

## **DETERMINATION OF TRIGLYCERIDE STORAGE IN HepPG2 CELLS SUPPLEMENTED WITH EXOGENOUS LIPIDS AND EDIBLE BIRD NEST EXTRACT**

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### **ABSTRACT**

Edible-bird nest (EBN) derived from swiftlets (*Aerodramus sp.*) is rich in glycoprotein. The EBN, beside being a good source of nutrients, possesses many benefits such as enhancement of proliferation and differentiation of cells, anti-cancer properties, and in the prevention of cardiovascular disease. The demand for EBN in Malaysia had increased by almost 4-folds since the year 1990, demonstrating the huge potential for EBN as one of the largest contributors to Malaysia's gross national income. In this study, the effect of EBN in facilitating storage of triglyceride (TAG) in the lipid droplets of HepG2 cells was determined using ELISA and the immunofluorescence techniques. The HepG2 cells treated with EBN supplementation showed higher TAG concentration than cells that were not treated. However, there was no difference in lipid concentration between cells treated with different concentrations of EBN supplementation. In conclusion, HepG2 cells treated with EBN supplementation showed greater ability to form and store lipids as lipid droplets than those not treated.

**Keywords:** edible-bird nests, triglyceride, lipid droplets, ELISA, immunofluorescence

## SEROLOGICAL AND MOLECULAR DETECTION OF WEST NILE VIRUS IN EQUIDS IN MALAYSIA

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### ABSTRACT

West Nile virus (WNV) is a zoonotic and arthropod borne flavivirus that can be transmitted by biting of infected mosquitoes. Horse is a dead-end host that is highly susceptible to the disease and may develop nervous signs as the result of infection. There is no data on the status of WNV infection in horses in Malaysia. This study aimed to determine the presence of anti-WNV antibodies in horses via serological and molecular methods using competitive ELISA (ID Screen ® West Nile Competitive Multi-species) and rt-PCR, respectively. Convenient sampling was performed to obtain sera and oropharyngeal swabs from 20 horses in Selangor, Putrajaya, and Kuala Lumpur, Malaysia. The results showed that 19/20 samples were positive for WNV anti-prE-antibodies. One step rt-PCR targeting highly conserved gene in-between capsid and pre-membrane revealed that 7 samples were seropositive for WNV. The positive bands were submitted for sequencing analysis showed that the virus had 98 to 99% homology with WNV strain from South Africa, USA, Hungary, Italy and North Europe. Phylogenetic tree revealed that the positive samples were aligned with strain found in USA, Austria, and Central Europe. As a conclusion, this study confirmed that Malaysian horses are seropositive for WNV and confirms that they have been exposed to WNV.

**Keywords:** West Nile virus, equine, flavivirus, ELISA, PCR, Malaysia

## **PERCEPTION AND KNOWLEDGE ON ANTIMICROBIAL USAGE AND ANTIMICROBIAL RESISTANCE AMONG PET OWNERS IN SELANGOR, MALAYSIA**

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### **ABSTRACT**

The emergence of antimicrobial-resistant organisms isolated from companion animals has serious implications for public health. The use of veterinary drugs is suspected to be one of the major causes for the development of antimicrobial resistance (AMR). Therefore, a cross-sectional study involving pet owners in Selangor, Malaysia was conducted to assess their level of knowledge and perception of pet owners towards usage of antimicrobial agents and AMR. A questionnaire comprising of sections including demographic characteristics, general management, assessment on knowledge and perception on antimicrobial usage and AMR was distributed to 90 pet owners. This study showed that 93.3% of respondents had sufficient knowledge on certain aspects on the usage of antimicrobials in pets. Sixty-six respondents (73.3%) had good perceptions on antimicrobial usage. The results suggested that there is association between age and education status ( $p < 0.05$ ) and the level of perception towards AMR. Although pet owners showed satisfactory knowledge and perception level, continuous educational and awareness programmes should be instituted to reduce occurrence of AMR among pets and pet owners.

**Keywords:** antimicrobial resistance, antimicrobial, knowledge, perception, pet owners

## CHARACTERISTICS OF BUFFALO BULL SEMEN COLLECTED USING THE ELECTRO-EJACULATION METHOD

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### ABSTRACT

Although there are efforts to enhance ruminant industry in Malaysia, the buffalo is often neglected as genetic and breeding sources. The purpose of this study was to determine the characteristics of buffalo (*Bubalus bubalis*) bull semen and sperm of fresh semen samples from 5 buffalos with age ranging from 4 to 10 years old. The semen was collected by the electro-ejaculation method. The pattern of electrical pulse delivery was controlled to mitigate pain and discomfort to the bull throughout the procedure of semen collection. The semen and spermatozoa evaluation were performed to determine quality. The semen samples had a mean volume of  $1.40 \pm 0.20$  mL, general motility of  $38.5 \pm 3.57\%$ , forward individual motility of  $22.86 \pm 3.59\%$ , rotating individual motility of  $4.28 \pm 1.30\%$ , vibrating individual motility of  $11.57 \pm 2.40\%$ , live sperm of  $40.85 \pm 2.80\%$ , abnormal sperm of  $21.22 \pm 4.49\%$ , and sperm concentration of  $357.14 \pm 50.21 \times 10^6$  sperms/mL. Among the sperm abnormalities,  $13.94 \pm 3.43\%$  were from the sperm tail,  $4.92 \pm 1.78\%$  sperm head, and  $2.35 \pm 1.04\%$  from sperm midpiece.

**Keywords:** buffalo bull, *Bubalus bubalis*, semen, spermatozoa, electro-ejaculation.

## **OPTIMISATION OF PROTEIN SEPARATION FROM EDIBLE BIRD'S NEST USING POLYACRYLAMIDE GEL ELECTROPHORESIS**

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### **ABSTRACT**

Edible bird nest (EBN) is made of salivary secretion from swiftlet's two sublingual salivary glands of male swiftlets (*Aerodramus fuciphagus*). Both protein (~60%) and carbohydrate (~30%) are major constituents of EBN. Currently, information on whole protein contents of EBN is limited. Polyacrylamide gel electrophoresis has been adopted as the common method for proteomic analysis to determine the nutritional benefits and identify presence of adulterants in EBN. In this study, the polyacrylamide gel electrophoresis was used to separate proteins and peptides from various types of EBN samples. Samples from farmed and commercial EBN were obtained and subjected to aqueous, acetone, non-ionic, and ionic detergent extractions. The protein profiles in 1-D and 2-D polyacrylamide gel electrophoresis were determined. The study showed the presence of a 50 kDa molecular weight band that is believed to be the same as the homologous acidic mammalian chitinase-like fragments (AMCase-like).

**Keywords:** edible bird's nest, 1-D polyacrylamide gel electrophoresis, 2-D polyacrylamide gel electrophoresis, protein profile

**ANTIMICROBIAL USAGE AND AWARENESS ON  
ANTIMICROBIAL RESISTANCE AMONG COMMERCIAL  
VILLAGE CHICKEN FARMERS IN SELECTED STATES OF  
MALAYSIA**

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**ABSTRACT**

Commercial village chicken farming in Malaysia continues to improve with the involvement of new farmers. However, there is concern on the usage of antimicrobials by the farms. A study was carried out in selected states of Malaysia to determine the level of antimicrobial usage, awareness on antimicrobial resistance (AMR), and to identify factors associated with the level of awareness on AMR among commercial village chicken farmers. A Questionnaire survey was conducted during farm visits and online. The results from this study showed that majority (77%) of the commercial village chicken farmers use antimicrobial in their farms. The results also showed that most of the farmers have average level of awareness on AMR (56%). There was no association between the practice of antimicrobial usage and education level with the level of awareness on AMR ( $p < 0.05$ ) of the farmers. Therefore, the study showed that commercial village chicken farmers had only moderate level of awareness on AMR.

**Keywords:** antimicrobial, antimicrobial resistance, awareness, commercial village chicken



**DETECTION OF HAEMOPARASITES  
IN JAPANESE QUAILS (*COTURNIX COTURNIX JAPONICA*)**

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**ABSTRACT**

Quails are known for its small size and low feed requirements, rapid growth, short gestation, making it an alternative to chickens as cheap source of protein. However, study on diseases in quail production is limited in Malaysia. The present study focuses on the detection of haemoparasites in Japanese quails (*Coturnix coturnix japonica*) in 2 houses. Thirty quails aged 25 to 35 days were used in the study. Thorough physical examination all quails were shown to be healthy. Blood samples were collected for thin blood smear showed the presence of *Plasmodium* sp. and *Leucocytozoon* sp. The prevalence of *Plasmodium* sp. was high at 93.3% in first house and 100.0% in second. However, the prevalence of *Leucocytozoon* sp. was low at 40.0% in first house and 46.7% in the second. There was no significant post-mortem finding in the quails. In conclusion, the study showed that the quails were positive for haemoparasites, although there were no clinical signs or significant abnormality in the organs, suggesting haemoparasitism did not affect quail production.

**Keywords:** Japanese quails, haemoparasites, *Plasmodium* sp., *Leucocytozoon* sp.

## **EFFECT OF VARIOUS EXTENDERS ON QUALITY OF POST-THAWED CRYOPRESERVED BUFFALO SEMEN**

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### **ABSTRACT**

Artificial insemination has become one of the most important reproductive biotechnology in the dissemination of superior genetic material in animal production. A study was conducted to evaluate the effect of different extenders on post-thaw cryopreserved buffalo semen quality. Seven semen samples were collected from 6 healthy swamp buffalo bull using an electro-ejaculator. The semen samples were evaluated for volume, colour, wave pattern, concentration, general and individual motility, live percentage, and morphology. Three extenders, Tris-based extender, skimmed milk extender, and Bioxcell® were used for semen cryopreservation. Cooling of semen was done for 4 h at 4°C. The samples were then packed into 0.25 mL straws, sealed, frozen, and stored in liquid nitrogen tank at -196°C. After 24 h, the samples were evaluated for forward motility, live and normal morphology percentage. Spermatozoa in all three extenders did not show motility, probably due to the low semen quality. There was no difference ( $p>0.05$ ) in normal spermatozoa morphology between semen samples stored in the three extenders, although the percentage of spermatozoa with normal morphology was better in Tris-based extender at  $75.72 \pm 1.3\%$  compared to skimmed milk extender ( $73.71 \pm 1.51\%$ ) or Bioxcell® ( $70.23 \pm 1.73\%$ ). Semen in Tris-based extender showed the highest live percentage of  $12.88 \pm 2.26\%$ , followed by those in skimmed milk extender ( $10.53 \pm 2.27\%$ ) and Bioxcell® ( $3.16 \pm 1.03\%$ ). In conclusion, Tris-based extender was the best among the three extenders tested and can be used for buffalo semen cryopreservation.

**Keywords:** buffalo bull, spermatozoa, cryopreservation, semen extender, spermatozoa morphology

## **EVALUATION OF BLOOD MINERAL STATUS OF GOATS REARED UNDER VARIOUS FEEDING PROGRAMMES IN UNIVERSITI PUTRA MALAYSIA FOSTER FARMS**

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### **ABSTRACT**

In Malaysia, small ruminant production systems depend upon the types of livestock and available feed sources. Intensive production systems, the performance of livestock is reliant on the provision of balanced nutrition. Inadequate supply of macrominerals and trace elements often lead physiological and biochemical dysfunctions or structural disorders. Thus, the objective of this study was to evaluate the blood mineral status of goat reared under the intensive system at the Universiti Putra Malaysia foster farms. Three goat farms were selected and 9 blood samples were taken from adult goats and 9 from young goats aged less than a year. The serum sodium, chloride, potassium, calcium, and phosphorus concentrations were determined using Quicklyte IMT system and BioLis 24i Premium Chemistry Analyzer. The results showed that goats from one farm only met the requirements for all 5 minerals for adult and grower goats. In two farms, the serum sodium and phosphorus concentrations suggest that the adult goat requirements for these minerals were not met. In conclusion, all farms in this study practiced adequate feeding programmes for adult and grower goats.

**Keywords:** minerals, calcium and phosphorus, foster farms, serum, feeding system

**THE EFFECTIVENESS OF ONE HEALTH  
PROBLEM-BASED LEARNING APPROACH FOR THE  
UNDERSTANDING OF ZOOBOTIC DISEASE CONCEPTS  
BY MEDICAL AND ECOSYSTEM HEALTH STUDENTS**

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**ABSTRACT**

One Health is recognised as a comprehensive and holistic approach to address the complex global health challenges at the human, animal, and ecosystem health interface. This concept calls for transdisciplinary collaboration among professionals from the human, animal health, and environmental health sectors in the implementation of intergrated programmes at the undergraduate level of education. In this study, a new and innovative teaching activity was piloted to introduce the One Health concepts and competencies in zoonotic disease investigation and management to medical and ecosystem health students. A total of 140 students of medical, veterinary, and ecosystem health back were subjected to a 1½-day in-situ activity at a deer park in close proximity to wilderness. Quantitative and qualitative data was obtained through a survey using the Likert scale from the participations. The results showed that the problem-based learning (PBL) activity was at 98% agreement as a good initiative in understanding the One Health concepts and approaches in the prevention and control of zoonotic diseases. All participants described that the knowledge, skills, and attitude acquired during the activities as effective towards the comprehension of zoonotic disease concepts and considered on applying these activities in future real-life situation.

**Keywords:** One Health, problem-based learning, zoonosis, students

**FORAGING BEHAVIOUR OF MUNTJAC (*MUNTIACUS MUNTJAK*),  
SAMBAR DEER (*RUSA UNICOLOR*), AND MALAYAN TAPIR (*TAPIRUS  
INDICUS*) IN ROYAL BELUM STATE PARK, PERAK, MALAYSIA**

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**ABSTRACT**

Herbivores such as Muntjac (*Muntiacus muntjak*), Sambar deer (*Rusa Unicolor*) and Malayan Tapir (*Tapirus Indicus*) lack nutrient content in their daily diet. Therefore, these herbivores tend to access salt lick to seek mineral especially sodium for the maintenance of osmotic balance, muscle activity, and nervous system function. The purpose of this study was to investigate the foraging behaviour of Muntjac, Malayan tapir and Sambar deer herbivores in three salt licks, Sira Kuak, Sira Batu, and Sira Tanah, at Royal Belum State Park, Perak, Malaysia. Camera traps were strategically placed at the salt licks to record the activities of animals. Photos and videos were collected and analysed. From the result, 23 types of species were captured by the camera traps at the salt lick. Muntjac, Malayan tapir and Sambar deer were most frequent users of the salt lick. The behavioural data of herbivores were analysed based on foraging behaviour, time, and sampling period. The study showed that Muntjac is a diurnal, Malayan tapir a nocturnal, and Sambar deer a crepuscular or nocturnal species. Salt lick that were topographically less hilly and nearer water source had the highest frequency of visits from the three species. The study concluded that foraging behaviour of Muntjacs, Malayan tapirs, and Sambar deer is very concentrated in areas with salt lick. The frequency of visits by the herbivores was influenced by the topography of salt licks.

**Keywords:** *Muntiacus muntjak*, *Rusa unicolor*, *Tapirus Indicus*, salt lick, activity pattern, foraging behaviour

**CLINICOPATHOLOGICAL EVALUATION OF RED HYBRID TILAPIA (*OREOCHROMIS* SP.) CHALLENGED WITH *STREPTOCOCCUS INIAE* AND *STREPTOCOCCUS AGALACTIAE* UNDER HEAT STRESS**

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**ABSTRACT**

Streptococcosis may causes a serious disease in both humans and other terrestrial animals. However, streptococcosis in fish commonly seen in intensive rearing systems, can cause high mortality, and eventually economical losses. The disease is always associated with *Streptococcus iniae*, *Streptococcus agalactiae*, and *Streptococcus dysgalactiae* infections. This study determined the clinical signs and severity of brain, gills, and kidney lesions in Red Hybrid Tilapia at 12-h intervals over a 48-h post-*Streptococcus iniae* and *Streptococcus agalactiae* inoculation, in the presence of heat stress. Fifty-four tilapia fishes were equally divided into three groups. Group 1 and group 2 were inoculated intraperitoneally with 10<sup>10</sup> cfu/mL *S. iniae* and *S. agalactiae*, respectively. Group 3 served as control fish. The fish were exposed to heat stress through the maintenance water temperature at 35°C. Organ samples were examined for macroscopic and microscopic lesions. Fish infected the bacteria developed clinical signs at different time points, which include air gulping, reduced appetite, motionlessness, and death. Infected fish developed macroscopic lesions including congestion of the kidneys and gills congestion, and simultaneous haemorrhages of the fins, tail, and operculum. Softening of brain and eyes was also observed at different time points of infection. Microscopic lesions observed in the organs include infiltration of inflammatory cells and congestion. Vacuolation, tubular degeneration, and secondary lamellar changes were observed in the brain, kidneys, and gills, respectively. Brains lesions was already significant after 12 h in fish infected with *S. iniae* and this group of fish showed higher mortality compared to *S. agalactiae*-infected (83%) and control (44%) fish. The results showed the severity of clinical signs and pathological lesions in fish infected with *S. iniae* and *S. agalactiae* were similar.

**Keywords:** *Oreochromis* sp., *Streptococcus iniae*, *Streptococcus agalactiae*, histology, heat stress

**BEHAVIOURAL STUDY OF CAPTIVE MALAYAN SUN BEAR  
(*HELARCTOS MALAYANUS*) AND ASIATIC BLACK BEAR (*URSUS  
THIBETANUS*) IN NATIONAL WILDLIFE RESCUE CENTRE,  
SUNGKAI, PERAK, MALAYSIA**

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**ABSTRACT**

In Malaysia, there is lack of behavioural studies on captive bears, especially the sun bears. Most captive bears exhibit abnormal and stereotypic behaviours because of the management and environments that reduced their opportunity to exhibit natural behaviours. This study conducted on two captive Malayan sun bears (Ampang and Soniya) and one captive Asiatic black bear (Lisa) at the National Wildlife Rescue Center, Sungkai, Perak, Malaysia, was designed to identify the baseline behaviours and effect of environmental enrichment (EE) to these behaviours. A controlled experiment was done to obtain baseline data prior to introduction of the two different types of EE. The EE1 was a sealed cardboard box (120 × 100cm) filled with shredded paper and 200g of groundnuts, while EE2 was five slices of white bread spread with peanut butter jam and hidden at 5 locations in the stall. Only one type of EE was employed each day. A total of 14 different behaviour repertoires were exhibited by the captive bears, while 2 bears exhibited stereotypic behaviours. Each bear exhibited active behaviours towards EE, spending more time on EE1. The bears exhibited more active behaviours with EE1 than EE2, and EE1 decreased the passive behaviours exhibited by Lisa and Soniya. Ampang did not change in passive behaviours (resting) after placement of either EE. Both EEs helped to reduce exhibition of stereotypic behaviours by the bears. This result showed that the placement of EE, especially EE1, can bring positive long-term effects by increasing active and reducing stereotypic behaviours.

**Keywords:** Malayan sun bear (*Helarctos malayanus*), Asiatic black bear (*Ursus thibetanus*), enrichments, stereotypic, behaviours

## **SURVEY ON AWARENESS OF SPOROTRICHOSIS AMONG CAT OWNERS IN SELANGOR, MALAYSIA**

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### **ABSTRACT**

In Malaysia, cats are the most common pets. There is potential zoonotic, long-term and high-treatment-cost risk of transmission of sporotrichosis to humans. The objectives of this study were to assess the cat owners' attitude on pet-contact, the level of awareness on zoonotic potential of feline sporotrichosis, and factors associated with level of awareness on sporotrichosis. A questionnaire was distributed randomly to cat owners in Selangor, Malaysia. One hundred respondents participated in the study during the 3-week survey period. All (100%) respondents had contact with their cats. Eleven percent of respondents knew that sporotrichosis is a zoonotic disease while another 23% knew what sporotrichosis is, but not its zoonotic potential. The majority (66%) of respondents had no knowledge of sporotrichosis. Factors that showed significant association ( $p < 0.05$ ) with the level of awareness on sporotrichosis were age of respondents and knowledge on zoonotic disease. This study showed that the level of awareness on sporotrichosis among cat owners in Selangor, Malaysia is low.

**Keywords:** zoonoses, cats, sporotrichosis, pet-contact, awareness



**DETECTION OF GASTROINTESTINAL PARASITES IN  
JAPANESE QUAILS (*CORTUNIX CORTUNIX JAPONICA*)**

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**ABSTRACT**

Quails are highly resistance towards common poultry diseases. Therefore, the health status of and disease prevalence in quails are often neglected. One of the most common diseases affecting poultry is endoparasitism. This study was conducted to determine occurrence of gastrointestinal parasites in Japanese quails (*Cortunix cortunix japonica*). Thirty quails were purchased from a farm in Malaysia. The quails were examined for clinical signs of parasitism. The faeces were examined via Modified McMaster technique, morphological identification of parasite by compound microscopy, gross lesions determined at necropsy, and detection of parasite gene was via conventional polymerase chain reaction (PCR). Physical examination revealed no clinical signs of parasitism. The pooled faecal sample showed presence of *Eimeria* oocysts. Three *Eimeria* species identified in the faeces were the common *E. tsunodai*, *E. uzura*, and *E. bateri*. Necropsy revealed normal serosa and mucosa of gastrointestinal tract without parasite. However, all blood samples subjected to conventional PCR revealed negative results. In conclusion, the occurrence of coccidia in this study suggests that natural infection is beneficial to Japanese quails through the stimulation of immune response.

**Keywords:** Japanese quails, gastrointestinal parasites, coccidiosis, *E. tsunodai*, *E. uzura*, *E. bateri*, polymerase chain reaction

## **STEREOTYPIC BEHAVIOUR AND ITS WELFARE IMPLICATIONS IN DOGS AT ANIMAL SHELTERS IN MALAYSIA**

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### **ABSTRACT**

Stereotypic behaviour, also known as compulsive behaviour, can be defined as abnormal invariant, repetition of motor pattern that serves no apparent function. It is believed stereotypic behaviours arise from conflict or frustration related to confinement or husbandry practice. This study examined the prevalence of stereotypic behaviour in dogs at animal shelters in Selangor, Malaysia. Forty-five dogs, housed in groups at 2 animal shelters, were observed for 5 common stereotypic behaviours, namely, persistent barking, pacing, excessive grooming, tail chasing, and excessive licking. The observations were catalogued using an ethogram. Fifteen staffs at the shelters were each given a questionnaire designed to obtain information on their level of awareness regarding stereotypic behaviours in dogs at animal shelters. The questions include types of stereotypic behaviour observed, knowledge on stereotypic behaviour, association of stereotypic behaviour with animal welfare, and perceived animal welfare at shelters. The results showed that the prevalence of stereotypic behaviour in dogs at animal shelters at the point of observation was 4.4 %, which was attributed solely to pacing behaviour. The owner and staff were generally aware of stereotypic behaviour among dogs in the shelter. Female staff of shelters were more aware of importance of stereotypic behaviours than males. Staff aged more than 26 years were more aware of stereotypic behaviours than those of younger age. Respondents with a degree or higher qualifications were more aware of stereotypic behaviour than those with high school certificates. In general, the prevalence of stereotypic behaviours in these dogs showed that owners and staff of animal shelters in Selangor, Malaysia, observed good animal welfare practices.

**Keywords:** dog, stereotypic behaviour, animal shelter, welfare

## **TOTAL BACTERIA, PSYCHROTROPHS, AND COLIFORM IN PASTEURISED COW MILK**

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### **ABSTRACT**

Milk quality is continuously monitored by the Department of Veterinary Services and Ministry of Health, Malaysia to ensure public health through the consumption of good quality milk. A study was carried out at Veterinary Public Health Laboratory of Faculty Veterinary Medicine, Universiti Putra Malaysia to determine the total bacteria, psychrotrophs, and coliform in commercial pasteurised cow milk available at the local supermarkets. Eighteen pasteurised cow milk samples of six brands were selected randomly in 3 batches. Standard plate count (SPC), psychrotrophic plate count (PPC) and coliform plate count (CPC) were performed on Day 0 (upon purchase) and Day 5 (after storage at 10°C in home refrigerator). On Day 0, all the milk samples showed SPC of  $< 1 \times 10^5$  cfu/mL, PPC was  $< 1 \times 10^6$  cfu/mL, and CPC was  $< 50$  coliform/mL. On day 5, the SPC in 16% of the milk samples were  $> 1 \times 10^5$  cfu/mL, while 5% had PPC  $> 1 \times 10^6$  cfu/mL, and 22% with CPC  $> 50$  coliform/mL. The SPC and CPC of pasteurised milk at the processing plants met the Microbiological Standard set in Food Regulation 1985, while the PPC met Microbiological Guideline of Pasteurized Milk Ordinance, FDA 2011. The increase in SPC, PPC and CPC were due to the growth of cold-tolerant bacteria; however, the milk was safe for consumption. It is recommended that pasteurised milk be consumed within 5 days upon storage in the home refrigerator.

**Keywords:** pasteurised cow milk, SPC, PPC, CPC

## DETECTION OF *CRYPTOCOCCUS NEOFORMANS* IN PIGEONS IN SELANGOR, MALAYSIA

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### ABSTRACT

*Cryptococcus neoformans* is the aetiologic agent of cryptococcal disease. This organism poses significant public health threat as it can affect immunocompetent individuals and animals. Pigeons are known to be the asymptomatic carrier for the fungus. The present study was conducted to determine the occurrence of *Cryptococcus neoformans* in pigeon droppings in Hulu Langat and Kuala Langat, Selangor, Malaysia. Fifty samples of fresh pigeon droppings obtained from selected areas were transported to the Bacteriology Laboratory, Faculty of Veterinary Medicine, Universiti Putra Malaysia, processed within 24 h. The samples were cultured onto Sabouraud's Dextrose agar and incubated at 37°C for 15 days. Identification of cultures was determined using Gram stain and API 20 C AUX identification test kits. The samples were negative for *C. neoformans*. However, other yeast fungi were present in the samples, which included *Candida* sp. (88%), *Trichosporon* sp. (28%), and *Saccharomyces* sp. (6%). In addition, mold fungi were also identified and they were *Aspergillus* sp. (18%), *Trichophyton* sp. (6%), *Mucor* sp. (4%), *Medurella* sp. (1%), and *Penicilium* sp. (1%). The study showed that the pigeons may play a role as reservoirs for zoonotic yeasts and molds.

**Keywords:** yeast (*Cryptococcus neoformans*), pigeons, Selangor, droppings, Sabouraud's dextrose agar.

## COCCIDIASIS IN FARMED CHICKEN IN SELANGOR AND MELAKA, MALAYSIA

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### ABSTRACT

Farm management practices are among risk factors for coccidiosis. This study investigated the incidence of coccidiosis in chicken farms in Selangor and Melaka, Malaysia and determined the relationship between the occurrence of coccidiosis and farm management practices. Pooled faecal sample was obtained from 15 selected chicken farms. The coccidial oocysts count per gram of faeces (OPG) was determined via the McMaster technique and identification of *Eimeria* spp. was by the morphology and size of sporulated oocysts. In 13 farms, the rate of coccidiosis ranged between 50 to 22150 OPG. The OPG was generally low when the farm uses coccidiostat (Mann-Whitney U (12) = 18.5, Z = -0.22, p = 0.826), practice routine medication (U (12) = 8, Z = -0.59, p = 0.553) and low stocking density (U (11) = 9.5, Z = -0.10, p = 0.914), and do not have other animals such cat or dog on the farm (U (12) = 2.5, Z = -0.937, p = 0.349). There is no significant difference in OPG among farms with different management practices. This finding is most likely due to the low sample size [Spearman correlation (r = (-0.250) – 0.837), p = 0.12 – 0.79]. *Eimeria* spp. identified were as follows: *E. maxima* (90%; n = 10/11), *E. acervulina* (81%; n = 9/11), *E. precox* (45%; n = 5/11), *E. mitis* (36%; n = 4/11), *E. tenella* (27%; n = 3/11), and *E. necatrix* (18%; 2/11). In conclusion, the study showed that coccidiosis is significantly present in chicken farms in the sampling area. However, management practices were not associated with coccidiosis in these farms.

**Keywords:** coccidiosis, chicken, *Eimeria*, farm management practices.

## **BODY CONDITION SCORE OF GOATS IN UNIVERSITI PUTRA MALAYSIA FOSTER FARMS**

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### **ABSTRACT**

Body condition score (BCS) is a subjective method in the evaluation of muscle and fat coverage of bones. In Malaysia, goats are mainly owned by smallholder farmers and these farmers are often not aware of the implications of poor body condition score to goat production. Therefore, this study aimed to evaluate the BCS of goats at Universiti Putra Malaysia foster farms. Seventy-three goats were randomly selected from 7 farms. The body weight, body length, circumference of chest (girth), and body score of the goats were determined. The results showed that 15.1, 30.1, 37.0, and 13.7% of the goats had BCS of 1.5, 2.0, 2.5, and 3.0 respectively, while animals with BCS of 1.0, 3.5 and 4.0 were equally distributed at 1.37% each. No correlation was observed between BCS and body weight or body length but there was weak correlation between BCS and heart girth ( $r=0.329$ ;  $p=0.005$ ). The study showed that 47% of the animals did not meet the recommended BCS of 2.5 to 4.0. Three out of 7 farms had more than 50% of their goats with BCS < 2.5, which may be attributed to poor feeding management. It is imperative that farmers are informed on the ideal BCS for their goats, and attending veterinarians should make recommendations on feeding management for goats of the foster farms.

**Keywords:** body condition score, goat, body weight, body length, heart girth

## **A RETROSPECTIVE STUDY ON PYOMETRA IN BITCHES AND QUEENS PRESENTED TO UNIVERSITY VETERINARY HOSPITAL, UNIVERSITI PUTRA MALAYSIA FROM 2008 to 2017**

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### **ABSTRACT**

Pyometra is a life-threatening disease in intact females. This study aims to determine and compare common clinical signs and laboratory results in bitches and queens, post-operative complications, and survivability of patients. Medical records of 77 bitches and 137 queens presented to the University Veterinary Hospital (UVH), Universiti Putra Malaysia, with pyometra between 2008 – 2017 were evaluated and analysed using Chi-square, Kaplan-Meier estimator, and binomial logistic regression. The median age for bitches that developed pyometra was 96 months and for queen, it was 18 months. The majority of patients experienced estrus more than 4 weeks prior to presentation, and were presented 7 days after the first clinical sign. The most prominent clinical signs observed was vaginal discharge in bitches (71.0%) and queens (85.4%). Blood parameter analyses showed leucocytosis due to neutrophilia and monocytosis. The bitches also showed increases in serum alkaline phosphatase concentration. The best method to diagnose pyometra was via ultrasonography with confirmatory percentage of 82.9%. Ovariohysterectomy was the suggested treatment for pyometra along with treatment with antibiotics. Metronidazole and amoxicillin with clavulanic acid were the antimicrobial of choice for pyometra in UVH. Post-operative complications occurred in 8.48% of cases. The average period for hospitalisation was 4.5 days for bitches and 3.9 days for queens. It is suggested that the survival of the animal with pyometra could improve with the reduction in days to surgery and days of hospitalisation.

**Keywords:** pyometra, vaginal discharge, bitch, queen, survival

## **AWARENESS, KNOWLEDGE, AND UNDERSTANDING OF CANINE PREVENTIVE HEALTH CARE AMONG DOG OWNERS IN KLANG VALLEY, MALAYSIA**

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### **ABSTRACT**

The number of pets in Malaysia is on the increase. However, the level of awareness, knowledge, and understanding of Canine Preventive Health Care among clients in Malaysia is unknown. Thus, this study determined the level of awareness, knowledge and understanding of Canine Preventive Health Care (CPHC) among dog owners in Klang Valley, Malaysia. A total number of 75 dog owners responded to this survey. Among questions asked includes those on vaccination, parasite control and prevention, neutering, feeding and nutrient, skin care and grooming, senior and geriatric care, and characteristic, and behavior of pets. The dog owners had a mean score of 11.83 out of 15 for the awareness and knowledge on CPHC with 76.0% scoring >10. Among the respondents, 74.67% relied on veterinarians for information and guidance on CPHC, with family and friends being a second most common source of information. This study demonstrated that a majority of respondents were aware and agreed with the basic needs of preventive health but showed lesser understanding of measures to be taken for the benefit of their dogs. In conclusion, there is need for veterinarians to address issues of lack of understanding of CPHC through client education to safeguard the welfare of pet dogs.

**Keywords:** preventive medicine, dog owners, canine health care



## VAGINAL CYTOLOGY AND MICROFLORA OF CATS IN ESTRUS AND INTERESTRUS

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### ABSTRACT

A variety of organisms inhabit the reproductive tract of queens and the microflora is believed to be affected by the stages of the estrous cycle. This study aimed to determine the relationship between estrus and interestrus phases and the aerobic bacterial culture from the vagina of queens. Twenty-six intact, Domestic Shorthair queens aged one year or older from two areas in Selangor, Malaysia were used in this study. Sterile vaginal cotton swab samples were subjected to cytological examination and bacterial culture. The results showed that 3 animals were in estrus while 23 in interestrus. Blood and MacConkey agar were used for bacterial culture. Gram-negative bacteria were only isolated from cats in interestrus while gram-positive bacteria were isolated from cats both in estrus and interestrus. Among queens, the most aerobic bacteria isolated were *Staphylococcus intermedius* (26%), *Streptococcus canis* (26%), *Escherichia coli* (14%) and *Staphylococcus pseudintermedius* (12%). There was no association in aerobic bacteria culture between cats in estrus and interestrus. The type of bacteria cultured from the vagina of the queens were not related to the phases of the estrous cycle.

**Keywords:** aerobic bacteria, cytology, Domestic Shorthair queens, estrus, interestrus

**IN VITRO ANTIMICROBIAL ACTIVITY OF *CIBISCUS ROSA-SINENSIS*,  
*CHROMOLAENA ODORATA* AND *CLINACANTHUS NUTANS* AGAINST  
AQUATIC BACTERIAL PATHOGENS**

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**ABSTRACT**

The emergence of antimicrobial resistant bacteria has become a critical issue to the aquaculture industry. There is need for new antibacterial compounds that will not produce development of resistant bacteria. Malaysia is rich in plants or herbs that could potential yield antibacterial compounds. This study determined the *in vitro* antimicrobial activity of *Hibiscus rosa-sinensis*, *Chromolaena odorata*, and *Clinacanthus nutans* aqueous and methanol crude extracts on the aquatic bacterial pathogens, *Aeromonas hydrophila* and *Vibrio alginolyticus*. Each extract was screened for antibacterial properties using the agar well diffusion method and followed by determination of the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) via the microdilution technique. The study showed that only *Hibiscus rosa-sinensis* and *Chromolaena odorata* methanol extracts displayed antimicrobial activity. The strongest antibacterial activity was shown by the *Chromolaena odorata* extracts. The *Hibiscus rosa-sinensis* extracts did not produce MIC or MBC. However, the MIC and MBC for the *Chromolaena odorata* on *Aeromonas hydrophila*, was 250 and 500 mg/mL, respectively and on *Vibrio alginolyticus* was 125 and 250 mg/mL, respectively. This study showed that extracts of local herbs possess activities against aquatic bacteria, thus, has great potential to be developed into cheap and easily available antibacterial compounds for the aquaculture industry.

**Keywords:** *Hibiscus rosa-sinensis*, *Chromolaena odorata*, *Clinacanthus nutan*, *Aeromonas hydrophila*, *Vibrio alginolyticus*, antimicrobial activity, agar well diffusion test, minimum inhibitory concentration, minimum bactericidal concentration

**FATTY ACIDS CONCENTRATION AND ANTIBACTERIAL PROPERTIES OF STINGLESS BEES (*TRIGONA THORACICA*) PROPOLIS ETHANOL AND OLIVE OIL EXTRACTS**

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**ABSTRACT**

Propolis has been used for medicinal purposes since ancient civilization due to its antimicrobial, anti-inflammatory, antioxidant, and antitumor properties. This study was aimed to investigate the fatty acids and antibacterial properties of stingless bees (*Trigona thoracica*) propolis ethanol and olive oil extracts. Propolis extract was prepared by soaking and shaking powdered propolis in solvents for two weeks. The total saturated fatty acids, monounsaturated fatty acids, and polyunsaturated fatty acids concentration of the extracts were determined. The results showed that propolis olive extract has the highest fatty acid composition. Between palmitic, linoleic, and linolenic acids, the palmitic acid was the most dominant component in the propolis olive oil extract, followed by linoleic and linolenic acids. Based on antibiotic sensitivity test (AST), minimum inhibitory concentration (MIC), and minimum bactericidal concentration (MBC), both *Staphylococcus aureus* and *Escherichia coli* were susceptible to the ethanol extract, while only *S. aureus* was susceptible to the olive oil extract. The MBC test showed that the range of concentration for propolis extract for the inhibition of bacterial growth ranged from 0.1 to 0.4 g/mL. The study showed that the propolis ethanol extract has higher bactericidal activity than the olive oil extract and has potential to be developed into antibacterial compounds.

**Keywords:** propolis, solvents, *Trigona thoracica*, fatty acid, antibiotic sensitivity test

## ILLUMINATION EFFECT ON PREDATORY BEHAVIOUR OF MALAYAN TIGERS (*PANTHERA TIGRIS JACKSONI*)

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### ABSTRACT

Tigers are believed to hunt during the dark. Tigers are equipped with the ability for light adaptation, by which light is reflected back to the retina. The presence of more rods than cones in the eyes of tigers also allows for better night vision. This study was done to determine the effect of illumination on predatory behaviour of captive tigers placed under a rehabilitation programme. The study also determined the agility of tigers in catching prey. Four captive tigers at the National Wildlife Rescue Centre (NWRC), Sungkai, Perak, Malaysia, comprising of one male and 2 females Malayan tigers (*Panthera tigris jacksoni*) and one male Malayan tiger hybrid (*Panthera tigris*) of various ages were used as subjects. This study was conducted at night with the provision of spotlights on the selected space as illumination. Chicken as live prey were placed in cages outside the enclosure. The average time taken for the tigers to reach the chicken's cage were significantly ( $p < 0.05$ ) faster without than with spotlight at  $21.44 \pm 4.70$  and  $41.75 \pm 5.23$  min, respectively. The response time appeared to be faster in the dark setting, however, it was significant ( $p = 0.02$ ) only for the wild caught adult female tiger. There was no difference in response time among gender and subspecies of Malayan tigers. Old aged tiger showed slower response in dark settings than the average adult-aged tiger at  $41.75 \pm 13.98$  and  $14.67 \pm 2.39$  min, respectively. In conclusion, the study shows the agility of the tiger at approaching preys were better in the dark than light setting.

**Keywords:** *Panthera tigris jacksoni*, Malayan tiger, vision sensitivity, agility, night vision

**RECTAL CARRIAGE OF EXTENDED-SPECTRUM  $\beta$ -LACTAMASE  
*ESCHERICHIA COLI* IN RESIDENT COMPANION ANIMALS AND THE  
ENVIRONMENT OF SMALL ANIMAL WARD,  
UNIVERSITY VETERINARY HOSPITAL,  
UNIVERSITI PUTRA MALAYSIA**

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**ABSTRACT**

Extended-spectrum  $\beta$ -lactamase (ESBL) is an enzyme produced by gram-negative bacteria that responsible bacterial resistance to  $\beta$ -lactam antibiotics. This study was conducted to detect and isolate ESBL-producing *Escherichia coli* from resident companion animals and the environment of Small Animal Ward, University Veterinary Hospital, Universiti Putra Malaysia. Rectal swabs were obtained from 7 dogs and 6 cats, while 14 environmental surfaces frequently in contact with both animals and personnel inside the ward were swabbed. Nine animal samples grown on eosin methylene blue agar were presumptively identified as *E. coli*, however, biochemical tests identified 8 isolates as *E. coli* and the other as *Klebsiella pneumoniae*. None of the environmental swabs were positive for *E. coli*. Double disc test revealed that none of the isolated *E. coli* expressed the  $\beta$ -lactamase. However, two isolates from two dogs displayed multi-drug resistance towards several groups of antimicrobial agents. Although ESBL-*E. coli* was not detected, the presence of multi-drug resistant isolates from two dogs indicated that healthy companion animals could serve as carriers of resistance genes and may contribute to propagation of antimicrobial resistance to the public and environment. Therefore, prudent use of antimicrobial drugs with proper control measures are crucial to prevent development of resistance and reducing the risk of spreading antimicrobial resistance in the community.

**Keywords:** extended-spectrum beta-lactamase (ESBL), *Escherichia coli*, companion animals, environment, multi-drug resistance

## **HERITABILITY ESTIMATE OF BIRTH WEIGHT OF SWAMP BUFFALO CALVES IN SABAH, MALAYSIA**

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### **ABSTRACT**

Estimation of heritability at an early age is needed to decide on the selection criteria and to predict the expected genetic gain of production animals. Birth weight trait is an expression of genotypes and the easiest measure to record. The objective of this study was to estimate the heritability and determine environmental factors affecting the birth weight of swamp buffalo calves. Data on birth weight of swamp buffalo calves born in 2015 to 2017 at the Buffalo Breeding and Research Centre (BBRC), Telupid, Sabah, Malaysia, were collected for the study. The heritability was estimated using parent-offspring regression method. The environmental factors affecting the birth weight of calves were evaluated using linear regression analysis in SPSS programme. The mean birth weight for swamp buffalo calves was  $31.5 \pm 5.33$ kg. The heritability estimate of birth weight was 0.29. The heritability in the buffaloes at BBRC was low. There were large phenotypic variations that may be due to the influences of environmental factors and herd management practices, rather than genetics. The low estimate of heritability indicates that improvement through selection is not feasible for the progress of traits. The traits of the buffaloes were significantly ( $p < 0.05$ ) influenced by year of birth and age of dam.

**Keywords:** heritability estimates, parent-offspring regression, birth weight, swamp buffalo calves, environmental factors

**SEROPREVALENCE OF *TOXOPLASMA GONDII* IN SMALL RUMINANTS OF UNIVERSITI PUTRA MALAYSIA FOSTER FARMS**

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**ABSTRACT**

Toxoplasmosis is a globally important zoonotic disease caused by *Toxoplasma gondii* capable of infecting all warm-blooded animals and human causing reproductive failures such as fetal death, abortion, stillbirth, infertility and neonatal mortality. A cross-sectional study was conducted to determine the seroprevalence of *T. gondii* and risk factors involved in small ruminants among Foster Farms, UPM, Selangor. A total of 120 sera were collected from eight farms and subjected to a commercial Indirect ELISA test (ID Screen® Toxoplasmosis Multi- species) to determine *T.gondii* specific IgG antibodies. Seroprevalence of *T. gondii* in farms ranged from 13 to 100% with an overall seroprevalence of 64% (77/120;CI: 0.55,0.72). Greater risk of acquiring *T. gondii* infection in a farm was higher when additional underground water was used (OR= 16.73, 95% CI: 1.98, 141.61; P= 0.010) as compared to tap water only, and in local animals (OR= 9.49, 95% CI: 2.38-37.75; P= 0.001) as compared to imported ones. The high seroprevalence of *T. gondii* in small ruminants among Foster Farms indicated that *T. gondii* could play a role in causing reproductive failures causing significant economic lost as well as posing public health risk. Awareness on control strategies, husbandry practices and public health significance of toxoplasmosis is greatly warranted.

**Keywords:***Toxoplasma gondii*, seroprevalence, small ruminants, ELISA, risk factors

**PREVALENCE OF LIVER AND RUMEN FLUKES AMONG  
RUMINANTS IN UNIVERSITI PUTRA MALAYSIA  
FOSTER FARMS**

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**ABSTRACT**

Liver and rumen flukes are trematode parasites that occur in ruminants almost worldwide. The present study aims to determining the prevalence of liver and rumen flukes among cattle, goats and sheep in Foster Farms, Universiti Putra Malaysia. Faecal samples were collected from of 30 cattle, 30 goats and 30 sheep from six Foster Farms, and subjected to simple sedimentation technique. The coprological examination revealed the prevalence of *Fasciola* and *Paramphistomum* in cattle to be 10 and 27%, respectively. None of goats and sheep faecal samples were positive for the flukes. The prevalence of fascioliasis in ruminants showed in this study highlights fascioliasis and paramphistomiasis are common in cattle than in sheep and goat.

**Keywords:** prevalence, liver fluke, rumen fluke, *Fasciola* sp., *Paramphistomum* sp., ruminant



## MEAT QUALITY OF MALAYSIAN TURKEY

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### ABSTRACT

Turkey meat is a delicacy among people of the Western world, that consumed especially during the festive seasons. For unknown reasons or may be due to lack of awareness of deliciousness, turkey meat is generally not acceptable to Malaysians. This study was conducted to investigate the meat quality of Malaysian Turkeys. The carcass composition of Malaysian turkey (*Meleagris gallopavo*), locally known as *Ayam piru*, was determined by dissection of whole carcass while the breast muscles were analysed for pH, colour, cooking loss, muscle tenderness, and proximate analytical parameters including of ash, dry matter, crude protein, crude fibre, and fat content. The pH was measured according to the direct method and the colour by Chroma meter CR 410 machine according to CIElab method. Tenderness analysis was performed using Stable Micro System Texture Analyzer (Model TA-XT plus, UK) equipped with a flat Volodkivich shear blade. Five carcasses of *Ayam piru* aged 50 days were obtained from AAF Agro Farm which located in Simpang Renggam, Johor, Malaysia. The carcass consisted 12.5% skin and fat, 18.2% bone, and 35.2% muscle. The pH for meat turkey was slightly acidic at 5.6. Meat cooking loss was 10% and the colour characteristic was L\* 57.32 a\* 9.09 b\* 12.89. Proximate analysis showed that turkey meat had 1.6%, ash content, 97.2%, dry matter, 2.7% moisture, 11.6% crude fat, 10% crude fibre, and 23% crude protein. The study showed that Malaysian turkey meat is healthy for consumption because the low fat and high protein and fibre contents.

**Keyword:** carcass composition, color, cooking loss, Ayam piru, Turkey meat, *Meleagris gallopavo*

## **RETROSPECTIVE STUDY ON COMMON BACTERIA ISOLATED FROM FELINE LOWER URINARY TRACT AND THEIR ANTIMICROBIAL RESISTANCE STATUS**

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### **ABSTRACT**

Feline lower urinary tract infection (UTI) caused by resistant bacteria is now becoming an emerging problem in the recent years, exposing the patients to a more complicated and detrimental condition. To date, there is lack of published data regarding antimicrobial resistance status of uropathogen bacteria among cats in Malaysia. The present study aimed to determine the common bacteria involved in feline lower urinary tract infection and their antimicrobial resistance status. The importance of antibiotic sensitivity test prior to treatment will also be emphasized. Bacteriological report of cat urine samples associated with feline lower urinary tract disease (FLUTD) between January 2013 and December 2017 was obtained from Bacteriology Laboratory, Universiti Putra Malaysia (UPM). A total of 141 bacteria have been isolated and identified. The bacteria were *Escherichia coli* (24.9%), *Klebsiella pneumoniae* (17.1%), *Staphylococcus sp* (16.3%), *Enterobacter sp* (14.1%), *Enterococcus faecalis* (12.1%), *Pseudomonas aeruginosa* (9.2%) and *Proteus mirabilis* (6.3%). The resistance of the isolated Gram-negative and Gram-positive bacteria were high towards amoxicillin-clavulanate, cephalexin, enrofloxacin and marbofloxacin. Failure to conduct antimicrobial sensitivity test prior to treatment can lead to various impacts such as prolonged duration of treatment, failure to resolve the infection, antimicrobial resistance issues and multidrug resistance.

**Keywords:** cats, urinary tract infection, antimicrobial resistant

## COMPARATIVE MORPHOMETRY OF MALAYAN GAUR (*Bos GAURUS HUBBACKI*) AND DOMESTIC BULL (*BOS TAURUS*) SPERMATOZOA

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### ABSTRACT

Malayan gaur or Seladang (*Bos gaurus hubbacki*) is a native wildlife in Peninsular Malaysian forest. Limited previous studies conducted on Malayan gaur bull semen quality but none had determined its entire spermatozoa morphometry. This study was carried out to measure and compare various parameters of entire spermatozoa morphometry of the Malayan gaur bull and domestic bull (*Bos taurus*). Spermatozoa morphometric was quantified in terms of the following morphological features: head length, head width, head area, head perimeter, mid piece length, tail length and overall length. Semen of a Malayan gaur bull was previously collected via electroejaculation. A total of 350 spermatozoa from a Malayan gaur bull and a domestic bull were selected, stained with eosin-nigrosin, and assessed with bright field microscopy at 1000× magnification. For Malayan gaur, the mean of head length was  $7.87 \pm 0.41 \mu\text{m}$ , head width was  $4.10 \pm 0.32 \mu\text{m}$ , head area was  $29.27 \pm 3.5 \mu\text{m}^2$ , head perimeter was  $25.78 \pm 1.61 \mu\text{m}$ , mid piece length was  $15.36 \pm 1.38 \mu\text{m}$ , tail length was  $47.22 \pm 3.94 \mu\text{m}$  and overall length was  $70.47 \pm 3.98 \mu\text{m}$ . For the domestic bull, head length was  $8.09 \pm 0.61 \mu\text{m}$ , head width was  $4.00 \pm 0.54 \mu\text{m}$ , head area was  $26.97 \pm 3.63 \mu\text{m}^2$ , head perimeter was  $25.34 \pm 1.57 \mu\text{m}$ , mid-piece length was  $14.79 \pm 1.55 \mu\text{m}$ , tail length was  $50.46 \pm 4.60 \mu\text{m}$ , and overall length was  $73.35 \pm 4.80 \mu\text{m}$ . The means of all parameters were all statistically significance ( $p < 0.05$ ) between Malayan gaur and domestic bull. In conclusion, the morphometry of Malayan gaur spermatozoa in this study showed normal features and the measurements were different when compared with domestic bull.

**Keywords:** Malayan gaur (*Bos gaurus hubbacki*), spermatozoa, morphometry, domestic bull (*Bos Taurus*)

**DETERMINATION OF NUTRIENT COMPOSITION  
AND PRESENCE OF BACTERIA  
IN RAW AND BOILED CHICKEN LIVER DIET**

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**ABSTRACT**

The preference in feeding pets with home-prepared and raw food diets containing chicken liver is increasing as it is supported by claims of its various benefits. The nutritional values and food safety are of concern especially when pets are fed with raw chicken liver as opposed to cooked chicken liver. Hence, this study was aimed to determine the nutrient composition and presence of bacteria in both raw and boiled chicken liver diet. A total of six samples for each of the raw and boiled chicken liver diet were prepared for the nutrient composition analysis. Both samples were also subjected to bacteria isolation and identification. All samples were cultured on the blood agar and tryptic soy agar for bacteria isolation. The isolated bacteria were identified using standard biochemical tests. Results indicated that all proximate analysis for moisture content in raw and boiled chicken liver were statistically different; (raw: 76.29%, boiled: 72.11%), dry matter (raw: 23.71%, boiled: 27.89%), crude fat (raw: 13.15%, boiled: 12.57%) and crude protein (raw: 36.85%, boiled: 35.10%), except for ash (raw: 1.48%, boiled: 1.45%). The bacteria species isolated from raw chicken livers were *Aeromonas species* (100%), *Streptococcus species* (58.33%), *Actinomyces species* (50%), *Proteus mirabilis* (25%) and *Salmonella species* (16.67%). No viable bacteria were isolated from boiled chicken livers. Thus, it can be concluded that the raw chicken liver contains higher nutrient composition but harbours numerous opportunistic bacteria that might compromise the general health of pets as well as the public.

**Keywords:** raw, boiled, chicken liver, proximate analysis, bacteria isolation

**EFFECT OF VARIOUS LIGHT COLOURS ON *STREPTOCOCCUS AGALACTIAE*-INDUCED INFECTION IN TILAPIA**

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**ABSTRACT**

A school of Tilapia were exposed to different colours of light prior to- and after *Streptococcus agalactiae* infection in order to identify the ideal colour that can maximize feed intake, minimize mortality rate, maintain optimum leukocyte (WBC) count and cortisol level. We hypothesized that the feed intake, mortality rate, WBC count and cortisol level of tilapia exposed to blue and red lights are significantly different compared to those that are exposed to white light. The fish were exposed to white, blue and red light respectively for 2 weeks before they were challenged with *S. agalactiae* infection. Blood samples were collected before and after the bacterial challenge for WBC count and assessment of the cortisol level, while the feed intake and mortality rate were recorded throughout the project. However, the results showed no significant difference ( $p>0.05$ ) in feed intake, mortality rate and WBC count among all groups of fish tested. The cortisol levels of fish exposed to blue light were unaffected compared to fish that were exposed to white light. However, fish that were exposed to red light had significant difference ( $p<0.05$ ) in the cortisol level compared to fish exposed to white light. Therefore, an exposure to red light was deemed stressful to the Tilapia as indicated by a high level of cortisol produced after the exposure.

**Keywords:** Tilapia, colour, light, *Streptococcus agalactiae*, leukocyte, cortisol

## **PATHOGENICTY OF *PASTEURELLA MULTOCIDA* SEROTYPE A:1, A:3 AND A:1, 3 IN CHICKENS**

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### **ABSTRACT**

In Malaysia, fowl cholera has been associated with *Pasteurella multocida* serotypes A: 1, A: 3 and A: 1, 3. Since different serotypes cause different severity of clinical signs, mortality and morbidity, and that bacterins for fowl cholera prevention is only serotype-specific, it is therefore important to determine the correct serotypes in order to choose the appropriate bacterins for prevention and control of this disease. This study aims to determine the pathogenicity of *P. multocida* serotypes A: 1, A: 3 and A: 1, 3 in experimentally infected chickens. Twenty, 3-weeks-old chickens were divided into 4 groups, each with 5 chickens. The chickens were inoculated with 10<sup>6</sup> colony-forming unit (cfu)/mL of A: 1, A: 3, A: 1, 3 and sterile phosphate buffer solution respectively, via subcutaneous route. No clinical signs and mortality were observed throughout the 3-day experimental period. All chickens were sacrificed for gross and histopathological examinations. All infected groups showed haemorrhage and congestion of liver with hepatomegaly, frothy lung exudates and hydropericardium. Histopathological lesions include: congestion of the liver and lungs, multifocal inflammation and necrosis of the liver, haemorrhages of the lungs, and inflammation of the spleen. The spleen and liver following infection in A: 1, 3 showed significantly more severe ( $p < 0.05$ ) histopathological lesions compared to A: 1 and A: 3. Absence of clinical signs and mortality in this experiment may be due to species resistance, age factor and bacterial load. The ability to re-isolate *P. multocida* serotype A only from some organs, particularly the spleen and liver indicates the affinity of the organism towards the organs and their involvement in transmission of disease.

Keywords: *Pasteurella multocida*, serotypes, chicken, subcutaneous

## **CURRENT STATUS AND LIMITING FACTORS OF ARTIFICIAL INSEMINATION USAGE AMONG DAIRY CATTLE FARMS IN SELANGOR, MALAYSIA**

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### **ABSTRACT**

A study on the usage of artificial insemination (AI) was conducted among dairy cattle farms in Selangor. The objectives of this study were to determine the percentage of dairy cattle farms that practice AI in their breeding programme and to identify factors that influence the AI usage in Selangor. A four-page questionnaire with 39 questions was constructed taking into consideration factors that influence the AI usage in the dairy farm. The questionnaire was randomly distributed to farmers from 50 dairy cattle farms in Selangor. A Chi square and Kruskal Wallis test were performed to determine the level of association between the variables. Results showed that out of 50 dairy cattle farms in Selangor, 27 (54%) use AI as part of their breeding programme. Nine factors were found to significantly influence AI usage in dairy cattle farms. The factors include: preference (P=0.01), education level (p=0.04), experience (p=0.05), awareness on AI services by Department of Veterinary Services, Malaysia (p=0.04), technician availability (P=0.01), technician adequacy (p=0.01), farm establishment years (P=0.02), record keeping practice (p=0.01) and pregnancy success rate (P=0.01). In conclusion, the study revealed that 54% of dairy cattle farms in Selangor use AI in their breeding program. The usage of AI by farms was found to be significantly influenced by the farmer, farm, animals and use of inseminator. In conclusion, more effort is needed to enhance AI usage in dairy farms.

Keywords: artificial insemination, dairy cattle farm, breeding programme

## **KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS ZONOTIC DISEASES AMONG SMALL RUMINANT FARMERS IN UNIVERSITI PUTRA MALAYSIA FOSTER FARMS**

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### **ABSTRACT**

Transmission of zoonotic diseases is an occupational hazard to farmers. A good understanding of knowledge, attitude and practices (KAP) among farmers is crucial in order to provide recommendations on preventive measures against zoonotic diseases. A cross-sectional study on the KAP towards zoonotic diseases among small ruminant farmers of Universiti Putra Malaysia foster farms, was conducted to assess their KAP levels. The study was conducted using paper-and-pencil method or through interview, involving 18 respondents from eight farms. The survey involved close-ended questions pertaining to demographic, farm background, knowledge, attitude and practices of farmers towards zoonotic diseases. The mean score (standard deviation) for knowledge, attitude and practice levels were 52% (35), 79% (26) and 57% (14) respectively. The majority of respondents agreed ( $p < 0.05$ ) on the importance of wearing gumboots (83%), handwashing after handling livestock (94%) and cooking of meat prior to consumption (94%). Although the present study revealed that the KAP levels of the small ruminant farmers were acceptable, the understanding on certain aspects of zoonotic diseases such as allowing cats and dogs to freely roam in the farm and farm biosecurity measures was deemed insufficient. Therefore, continuous guidance and education on preventive measures of zoonotic diseases among farmers in Foster Farms should be emphasised.

**Keywords:** zoonotic diseases, knowledge, attitude, practice, small ruminant farmers



## IDENTIFICATION OF HELMINTHS AND ECTOPARASITES IN SPRAGUE-DAWLEY RATS

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### ABSTRACT

The laboratory rat (*Rattus norvegicus*) is widely used in biomedical research. The infestation of helminths and ectoparasites may alter the validity of results in research. Therefore, an early health analysis of the laboratory animals may provide a better insight towards preventing diseases which may affect the outcome of an experiment. A total of 16 Sprague-Dawley rats obtained from the Animal Resource Unit (ARU), Faculty of Veterinary Medicine, Universiti Putra Malaysia, were grouped based on age and sex, with 4 rats in each group. The methods used for helminth identification include: perianal tape test, faecal floatation, and direct examination of the intestines while ectoparasites were examined by fur pluck test and carcass immersion in alcohol. In this study, only *Syphacia muris* was identified and at a very low amount comprising of 8 adult helminths. However, all rats showed presence of *Syphacia muris* eggs. Results revealed that 5 out of 8 adults and 1 out of 8 juveniles were positive for developed worms. Comparison of data from both gender showed that 3 out of 8 animals were positive for developed worms. Thus, this study showed that adult rats harbour more worms than juveniles possibly due to a longer exposure to the worms. However, there were no statistically significant differences between gender and age. Additionally, no ectoparasites were found on these animals. In conclusion, Sprague-Dawley rats from ARU harbour *Syphacia muris*, a helminth commonly found in healthy laboratory rats.

**Keywords:** ectoparasites, helminths, laboratory rats, *Syphacia muris*

## **MALAYAN TIGER (*PANTHERA TIGRIS JACKSONI*) RESPONSE TOWARDS ANIMAL-BASED OLFACTORY STIMULATION**

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### **ABSTRACT**

The lack of stimulation and complexity of a captive environment necessitate the provision of environmental enrichment(s), especially if the captive animals are to be reintroduced into the wild. The role of enrichment in the form of olfactory stimulation in enhancing the welfare of captive animals is well recognized. Despite numerous studies conducted on animals' response towards various types of environmental enrichments, well-documented studies and literature on the response of animals towards olfactory stimulation via provision of enrichments are limited. This study aims to investigate the behavior of five Malayan tigers (*Panthera tigris jacksoni*) in response to animal-based olfactory stimulation such as the goat-scented gunny sacks which were introduced inside the animals' enclosure. The association between age, gender, origin and period of captivity of the tigers and their response towards the enrichment items was calculated using an independent t-test. There were no significant differences ( $P > 0.05$ ) between the factors analysed and the response shown. However, the introduction of the enrichment items stimulated and increased the frequency of certain behaviours such as sniffing (55%), carrying (25%), biting (18%) and tossing (2%) and, the active behaviour of tigers.

**Keywords:** *Panthera tigris jacksoni*, environmental enrichment, olfactory, welfare

**RETROSPECTIVE SURVEY ON REASONS AND QUALITY OF LIFE OF DOGS THAT UNDERWENT LIMB AMPUTATION AT UNIVERSITY VETERINARY HOSPITAL, UNIVERSITI PUTRA MALAYSIA FROM 2011 to 2017**

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**ABSTRACT**

Limb amputation in a dog is performed for various reasons such as neoplasia, severe trauma with non-operable fractures, ischaemic necrosis, osteomyelitis or soft tissue infection. There are limited studies that describe the common causes for limb amputation in dogs and its effect on the quality of life among pet dogs in Malaysia. Misconceptions from the public regarding limb amputation in addition to the owner's own attitude towards their pet dog as an amputee, often influence the decision-making process thus inflicting poor welfare on the affected dog which may in many cases, lead to euthanasia. Thus, this study was carried out to determine the reasons, risk factors and clinical outcome for limb amputation in dogs at the University Veterinary Hospital (UVH) Universiti Putra Malaysia, between 2011 and 2017. This study also aims to evaluate the owner's satisfaction based on the perception of their dog's quality of life and adaptation following amputation of a limb, by means of a structured questionnaire. Twenty-three cases of limb amputation in dogs were reviewed from the UVH case log books. Data including signalment, body weight, level of limb amputation, reasons for amputation and clinical outcome (recovery duration and post-operative complications) were collected and analysed. Additionally, a survey was conducted by telephone or email. Information on the owner's satisfaction, preference in opting for limb amputation procedure for their dog(s) when faced with a similar problem, adaptation process of their dogs after limb amputation, and behavioural changes observed was obtained. The main reason for limb amputation in this study was neoplasia, with an average duration of hospitalization of seven days. There was no significant association between post-surgical duration of hospitalization and the dog's age, gender, breed, body weight, reasons for amputation, whether a forelimb or hindlimb was amputated, or complications in relation to the amputation. A total of 84.2% of the owners stated that their dog regained a normal quality of life post amputation and adapted very well to walking on three limbs. A total of 79% of the owners would choose the procedure for their pet(s) if required. Overall, the respondents perceived that their dogs adapted well on three limbs in addition to regaining a good quality of life after recovery.

**Keywords:** dogs, amputation, quality of life, adaptation



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