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KNOWLEDGE AND ATTITUDE TOWARDS DAIRY CATTLE UDDER HEALTH MANAGEMENT AMONG VETERINARY-RELATED PERSONNEL IN SELANGOR, MALAYSIA

FAIZATUL AKMAR BINTI AHMAD KAMSHAH

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FAIZATUL AKMAR BINTI AHMAD KAMSHAH

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CERTIFICATION

It is hereby certified that we have read this project paper entitled "Knowledge and attitude towards dairy cattle udder health management among veterinary-related personnel in Selangor, Malaysia", by Faizatul Akmar Binti Ahmad Kamshah and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course of VPD 4999- Final Year Project.

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"Whatever our individual troubles and challenges may be, it's important to pause every now and then to appreciate all that we have, on every level. We need to literally count our blessings, give thanks for them, allow ourselves to enjoy them, and relish the experience of prosperity we already have." – Shakti Gawain

Finishing final year project in the midst of a pandemic posed a different challenge entirely. Thank you to those who contributed either directly or indirectly throughout my journey in making this project successful.

Special thanks and love for my study mates, Kumbs & Bunga, and DVM2021 class for their company, joy and support in whatever I do. Also, my precious playlist, you were the music of my ears that gave me comfort, happiness and strength. Thank you always.

Dear self, friends and acquaintances, be thankful for the difficult times. During those times we grow. Be thankful for the limitations as they give us opportunities for improvement and most importantly, be thankful when we are tired and weary because it means we've made a difference.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Sijil Pelajaran Malaysia	SPM
Somatic cell count	SCC
Bulk milk somatic cell count	BMSCC
Bedding bacteria count	BBC
Clinical mastitis incidence rate	CMI
Department of Veterinary Services	DVS
Taman Pertanian Universiti	TPU
Doctor of veterinary medicine	DVM
National Mastitis Council	NMC

ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD4999 – Projek Ilmiah Tahun Akhir

PENGETAHUAN DAN SIKAP KAKITANGAN PERKHIDMATAN VETERINAR TERHADAP PENGURUSAN KESIHATAN AMBING SUSU LEMBU TENUSU DI SELANGOR, MALAYSIA

Faizatul Akmar binti Ahmad Kamshah

Penyelia: Dr. Rozaihan binti Mansor

Penyelia Bersama: Dr. Nur Indah binti Ahmad

Kesihatan ambing susu dianggap sebagai salah satu komponen penting dalam program kesihatan gerompok. Umum diketahui bahawa penyakit melibatkan ambing susu menyumbang kepada kerugian ekonomi dalam kalangan penternak tenusu. Kajian ini dijalankan untuk menilai pengetahuan dan sikap kakitangan perkhidmatan veterinar di Selangor berhubung tahap pengurusan kesihatan ambing susu yang dilaksanakan sewaktu khidmat rundingan dan nasihat kepada petani. Soal selidik yang disahkan telah diedarkan kepada 19 individu. Pengetahuan dan sikap responden didapati tidak memuaskan di mana 5.26% (1 daripada 19 responden) mempunyai pengetahuan yang baik dan 36.8% (7 daripada 19 responden) dengan sikap yang baik terhadap pengurusan kesihatan ambing susu. Kelayakan pendidikan antara ijazah doktor perubatan veterinar dan diploma dilihat mempunyai perubahan yang ketara terhadap skor pengetahuan sementara kumpulan Sijil

Pelajaran Malaysia (SPM)-Diploma adalah signifikan dalam kalangan responden. Pengalaman kerja dan kepastian dalam mendiagnosis penyakit adalah faktor yang paling diambil kira dalam menentukan sesebuah rawatan dengan 79% (15 daripada 19 responden) dan 74% (14 daripada 19 responden). Berdasarkan pemerhatian, alat-bantu mengajar mengenai pengurusan kesihatan ambing susu disediakan seperti panduan praktikal mengenai kesihatan ambing susu (57.9%) manakala 21.20% daripada responden tidak menyediakan sebarang alat-bantu kepada penternak. Komponen mesin pemerahan susu dan persekitaran/perumahan dipersetujui sebagai strategi yang paling penting untuk meningkatkan kesihatan ambing susu. Penyakit ambing susu sebagai sebab utama penggunaan antibiotik diakui oleh responden dengan majoriti sebanyak 84% (16 daripada 19 responden). Kesimpulannya, pengetahuan dan sikap kakitangan perkhidmatan veterinar adalah saling berkait antara satu sama lain. Namun begitu, tiada perkaitan yang dapat dibuktikan untuk setiap faktor sosio-demografik dengan pengetahuan dan sikap mereka.

Kata kunci: lembu tenusu, pengurusan kesihatan ambing susu, kakitangan perkhidmatan veterinar, pengetahuan, sikap.

ABSTRACT

Abstract of the project paper presented to the Faculty of Veterinary Medicine in partial requirement for the course of VPD 4999 – Final Year Project

KNOWLEDGE AND ATTITUDE TOWARDS DAIRY CATTLE UDDER HEALTH MANAGEMENT AMONG VETERINARY-RELATED PERSONNEL IN SELANGOR, MALAYSIA

By:

Faizatul Akmar Binti Ahmad Kamshah

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Udder health is considered to be one of the important components under herd health programme. It is well-known that udder diseases contributed to the highest economic loss among dairy farmers. In this study, knowledge and attitude of veterinary-related personnel in Selangor were assessed in regard to their extent of udder health management opted during consultation and advisory to the farmers. Validated questionnaires were distributed to 19 individuals. Knowledge and attitude were non-satisfactory where 5.26% (1 out of 19 respondents) with good knowledge and 36.8% (7 out of 19 respondents) with good attitude on udder health management. Educational qualification between degree in veterinary medicine and diploma was seen significant towards knowledge scores meanwhile Malaysian Certificate of Education (SPM)-Diploma group was significant in

attitude scores among the respondents. Working experience and certainty in diagnosing disease were the most probable factor in deciding for treatment plan with 79% (15 out of 19 respondents) and 74% (14 out of 19 respondents) respectively. It was observed that educational tools on udder health management were provided to the farmers such as practical guide on udder health (57.9%) however 21.20% provided none of the tools. Milking machine and environment/housing components being agreed as the most important strategies to improve udder health. Udder diseases as the main reason for antibiotic usage was acknowledged by the majority with 84% (16 out of 19 respondents). It can be concluded that, there was association between knowledge and attitude of the veterinary-related personnel however no association proven for each socio-demographic variables.

Keywords: dairy cattle, udder health management, veterinary-related personnel, knowledge, attitude.

1.0 INTRODUCTION

Udder health is defined as mean somatic cell count (SCC) over lactation that is considered to be the most used tool for udder health management. In one instance, udder health parameters used to evaluate udder health were as the following; clinical mastitis incidence per 100 cows per year, subclinical mastitis incidence rate per 100 cows at risk per year, average subclinical mastitis prevalence and average bulk milk somatic cell count (BMSCC) (Santman-Berends et al., 2016). According to Stevens et al. (2019), udder health and milk quality were the ultimate goals in dairy farms where it involved the management of bedding material, facility design and management, parlour procedures host resistance and resilience by lowering down bedding bacteria count (BBC) and teat end exposure. Complexity of the each component in maintaining udder health corresponded with Shock et al. (2020) in which continuous and informative attempts were needed in tackling udder diseases. It is important to create awareness and implement the udder health management components among the farmers since managing them could enhance udder vigour (Jansen et al., 2010). Veterinarians are to serve as key communicators for continuous support and motivation in udder health programs, in which they play an important role as foundation for animal health knowledge and provider of hands-on instruments to the farmhands. In this particular topic, communication element is considered as the most important skills for the veterinarians as they are required to communicate not only to the farm workers or farmers but also to the veterinary-related personnel. Moreover, a strategic and precise manner through guidance of the professionals showed better outcomes over the time (Barkema et al., 1999). In a study, it is observed

that existence of huge practices barrier in driven practitioner with the farmer may eventually decreased their potential as intermediary despite their vast knowledge and direct interaction (Lam et al., 2011). It was postulated that written, herd-specific udder health refinement strategy and incorporation of a substructure plan result in improvement of udder disease in managing dairy herds (Tschopp et al., 2015). Various educational tools and informative materials are available as part of health programs to introduce farmer to udder health, all-inclusively to reduce occurrence rate of udder-related diseases in the farms. Typically, farmers that did not make use of educational tools and information given were likely to show a sudden event of infection ongoing with the udder, mastitis included; without known reasons (Shock et al., 2020).

In this survey, understanding of veterinary-related personnel in udder health management will be assessed in regard to their knowledge and attitude in approaching udder diseases. One of the highest population of ruminants are located in Selangor among other states in Peninsular Malaysia (DVS, 2017) hence this study will be targeting veterinary-related personnel in Selangor, Malaysia. In Malaysia, not only veterinarians but associated veterinary-related personnel are assigned to guide farmers on overall herd management where udder health management included. This shows that, every veterinary-related personnel are as important as the veterinarians. Hence, in order to prevent substantial difference in case definition and reported case rate of clinical udder diseases, study on level of understanding perceived between the veterinary-related personnel are particularly important to ensure application of sufficient techniques in

discovering, detection rate, documentation and following up of any clinical udder disease (Ruegg, 2012).

Awareness among farmers toward udder and herd health consequential events should be improved since suitable advancement is required to prevent potential issues from becoming apparent. One of the important and common diseases is mastitis influenced by multiple factors leading to reduce in milk production, increase in health cost and culling rate and sometimes death (Melchior et al., 2006). Mastitis can be categorised into clinical and subclinical where almost 50% cases of clinical mastitis are re-infection hence they caused unfavourable economic situation to the farmers which include reduce milk production, higher mortality rate and risk of culling post treatment for persistent infection. Concern on animals well-being, decreasing of antibiotic utilisation as well as disturbances in farm daily activity were addressed in an observation of a dairy herd with record of nearly half of the herd suffered clinical mastitis re-infection (Wente et al., 2019). Another drawback involved compromising animal health and welfare complemented by growing health care costs and even fatality (Melchior et al., 2006). This is the part where veterinary comprehension on herd health management including udder health management, has grown to be the main key. In addition, engagement of professionals namely the veterinary-related personnel, will increase level of acceptance of the farmers towards advice and proposed managerial plan and contribute in forging a reliable association between the two groups as it believed to bring out amelioration in animal health (Derks et al., 2013; Sorge et al., 2010).

In this study, addressing current perception of veterinary-related personnel in dairy industry was the utmost goal since their level of knowledge and attitude toward udder health management were reflected through the survey. To light, this study can provide information on level of understanding in udder health among veterinary-related personnel in Selangor. This continuous and informative attempts need to be set in order to improve farmers' decision on reliable diagnostic test, precaution and execution of organized treatment protocol with a rational presumption in tackling udder diseases (Shock et al., 2020).

2.0 LITERATURE REVIEW

2.1 Udder health and diseases

Udder health can be improved through implementation of best management practices. Three distinctive paths for mastitis in dairy cows commonly take place through herd exposure toward infectious organism, introduction of environmental organism in lactating cows and during dry period (Godden et al., 2003). It is observed that acceleration and expansion of intramammary infections in herd were encouraged by poor udder health, milking practices and housing surrounding among the smallholder dairy herds (Kivaria & Noordhuizen, 2007). Previous study showed that management of mastitis can be challenging due to farm-specific approach and most farmers confront with on and off udder problems across the time without an ability to recognise the cause. Over one-fourth of the farmers realise their differences in understanding the subject with respect in impeding mastitis (Kuiper et al., 2005).

Farmers often devastated over the fact that unidentified aetiological agents associated with mastitis and high SCC in which lead to failure for proper diagnosis due to insignificant finding from milk culture. Milk samples send for laboratory showed no bacterial growth in one-fifth up to half of the total samples presented to the laboratory (Makovec & Ruegg, 2003). One-third of aetiological agents causing mastitis are associated with recurrent clinical mastitis cases and differ greatly in term of perseverance and recurrence. Moreover, it is not possible to tell apart between re-infection and a lasting infection as it may cause by resolute intramammary infection possibly from unsuccessful therapy or recrudescence of the quarter after disease resolved (Swinkels et al., 2013). Knowledge on mastitis and antimicrobials resistant bacteria in milk studied are fairly low in Malaysia and aetiological agents isolated can provide perception on geographic location, pathogenicity and function of the bacteria in mastitis of dairy cows population (Othman & Bahaman, 2005). Precaution in approaching udder health management among dairy herds are diverge due to variation in mastitis aetiological agent dissemination and progression can be guaranteed through herd-specific management perspective (Lam et al., 2013).

2.2 Risk factors involving udder diseases

Risk factors for udder diseases were investigated and reported in literatures before. A study by Santman-Berends et al. (2016), indicated that by applying appropriate management practices were able to reduce clinical mastitis incidence rate (CMI). It was reported that cleaning of slatted floors less than once per day, selecting Holstein-Friesian as the dominant breed, practicing post milking teat disinfection and treatment of high SCC

cows with antimicrobials were related to high CMI. Key element of performance index associated to animal health including persistent supervision on SCC data, assisting in observation, establishment and rank of clinical mastitis; all in all should be performed by veterinarians participating in udder health management. A framework in assessing severity and clarification of udder issue is crucial in order to standardise the milk quality objectives and to link occurrence of udder disease in depth. The disease itself may vary in terms according to individual or communication hurdle hence correct treatment can only be deployed with involvement of professionals given that adequate treatment log are kept (Ruegg, 2012). Frequently, intensive type of dairy farm management led to diverse probable pathogenic organism manifestation. However, lowering environmental pathogens causing udder disease pose as a challenge due to housing condition such as bedding, barn outline, stocking rate and waste management (Hogan et al., 1989; Zdanowicz et al., 2004). Some farms may rely on computerised system and workers experience in detecting mild sign of udder disease but active communication between practitioners and farm personnel are to be considered as important in order to provide accurate diagnosis hence prevent issues in matching the farm objectives accordingly.

2.3 Recommended strategies to improve udder health

A study by Tschopp et al. (2015) discussed on the importance of having a written herd-specific udder health strategies report where each report was tailored made by five experienced veterinarians. Components of the survey included were milking hygiene followed by milking machine, environment or housing, other, and dry period. Findings of the report were observed in contrast with the same study model conducted in a different

geographical area. The differences observed were discussed and concluded that the following findings actually influenced the effectiveness of udder health recommendations given. Farmer compliance level can be influenced when numerous suggestion in improving udder health given at one time (Sorge et al., 2010). Moreover, inability of the professionals in stressing on the most important strategies to be performed on their farm management also lead to the same outcome. Meanwhile, failure of establishing a good communication between the dairy farmers, farmers incapable of adopting listed recommendations into their management and their satisfaction with existing udder health management practices were additional reasons that may lead to such findings (Tschopp et al., 2015). According to Jansen et al. (2010), internal motivational factors actually determined the success of a farmer towards udder health improvement recommendations.

2.4 Understanding and perception of udder health management

Social and economic standing were observed to cause big differences in disease control and prevention practiced by the dairy cattle farmers in Malaysia (Amna et al., 2018). Factors discussed by Suntharalingam & Ahmad, (2015) including veterinarian working with government have less experience dealing with large ruminants, disinterest in working with large ruminants, inflexible working hours, and failure to adjust services according to their working environment in regards to farmers. According to local production of fresh cow milk in 2012, Malaysia have only 5% self-sufficiency level and relying on the importation of various milk products to meet the local consumption. In addition, 85% of the dairy cattle farmers in Malaysia are smallholder with herd count less than 30 animals and major contributor for local production comes from anchor companies

(Suntharalingam & Ahmad, 2015). It has been discussed in literatures that farmers in dairy cattle industries in Malaysia are having inconsistent compliance with disease control program and failure of good management practices as well as disease control and prevention were observed due to this issue. Farmers notice that source of knowledge and capability in overcoming udder health issues on their farms are crucial though they may acquire tools related in diagnosing and preventing udder diseases. Key to success in udder health management are depending on ability of a veterinarian's constructive perception, appropriate diagnosis, ability to analyse suitable outcome of the given therapy and execution of specific herd preventive medicine connected to the aetiologic agents through constant monitoring. From another study, other strategy of udder health-refinement that can be considered by gathering dairy farmers for a sharing and discussion in a co-equal study groups to discuss on their udder health encounter as they are more inclined to receive information compared to their private veterinarians (Lam et al., 2011; Vaarst et al., 2007). Practitioners need to cooperate with the farmers in acknowledging the restriction and principal behind performing laboratory diagnostic test in both clinical and subclinical cases to nurture a positive point of view toward ancillary test with hope that incidence of mastitis can be minimize on their farm (Shock et al., 2020).

3.0 MATERIALS AND METHODS

3.1 Study design

This is a semi-quantitative, cross-sectional, questionnaire-based study aims to determine the current knowledge and attitude of veterinary-related personnel in dairy cattle industry on udder health management using convenience sampling method.

3.2 Survey

The questionnaire consisted of four 5-point Likert scales and the rest were multiple-answers questions and choose either one questions. The respondents answered a set of questionnaire developed based on previous studies (Falkenberg et al., 2019) and modification from set of questionnaire used in other several studies but with a different target population (Sadiq et al., 2018; Tschopp et al., 2015). Various literature on suggested udder health care, predisposing factors were grouped together and compiled as questions and statements. First section evaluates their socio-demographic and general questions (e.g., working experience and working practices, source of knowledge), while the second section evaluates their knowledge on udder health management by selecting on general and specific questions according to their level of understanding (e.g., definition, epidemiology study and components of the management). The third section requires participants to record their attitude in approaching udder disease and udder health management. Final part evaluates their preferred monitoring approach on udder health management among farmers as it is a crucial part for their overall understanding in the particular topic by agreeing to statement listed and scoring questions from 1 to 5 (Table 1).

3.3 Pretesting

Pretesting conducted on 20th August 2020 to test the respondents' understanding on the questionnaire provided prior to the study. There were 5 veterinary-personnel who fulfilled the inclusion criteria selected to be the respondents in the pre-testing and results yielded from the pilot study were not included in the actual data. Comprehension of instructions and all questions from the questionnaire, time taken for completion on pre-training section of questionnaire were assessed and problems raised in the session were identified and addressed based on the respondents' feedback. The instrument for the study were reassessed and amended accordingly after the pre-testing.

Question type	Question content
Section A (Socio-demographic and general)	District, age, gender, time allocated for treatment, years practiced, species attended, frequency attending case per week, educational qualification, source of information
Section B (Knowledge)	Introduction to udder health, common diseases and aetiological agents, clinical signs, mastitis control plan.
Section C (Attitude)	Antibiotic and anti-inflammatory usage, following up treatment outcome, identification of aetiological agents, frequency of cases reported following udder diseases, factors influence likelihood of treatment decision.
Section D (Monitoring)	Agreement towards recommended udder health strategies and statement-based questions from literature, educational tools, treatment follow-up.

Table 1: Question types and content of the udder health management survey

3.4 Study location and population

A total of 21 personnel working directly with farmers under Department of Veterinary Services (DVS) Selangor involved in this study. The study was conducted in DVS Selangor, Sepang with participation of veterinary officers, assistant veterinary officers and veterinary assistants. In addition, 6 veterinary-related personnel associated with dairy cattle from Taman Pertanian Universiti (TPU), Universiti Putra Malaysia were also included in this study. Participants meeting the inclusion criteria were invited to participate in the study in voluntary basis. The study was conducted in accordance with protocol approved by the Ethics Committee of University Putra Malaysia (#JKEUPM-2020-331). Respondents involved were of all nationalities and ethnicities, male or female, and aged 18 years old and above. Respondents who fail to fulfil the inclusion criteria, refuse to participate or fail to cooperate with the investigators during the sessions will be excluded from the study. The hardcopies were distributed to the targeted participants during VETPIL@Ruminan programme in DVS Sepang on 2nd September 2020 meanwhile the absentees were contacted through email.

4.0 RESULTS

Twenty-seven surveys were sent out (21 in hardcopies and 6 through e-mail) and twenty-one answered but two of them were answered ambiguously and incomplete hence they were excluded from data analysis. Therefore, the overall response rate was 78 % (21/27). Data analysis was completed using IBM SPSS Statistics for Windows (version 25, IBM Corp., Armonk, N.Y., USA). Descriptive statistics, reliability analysis and rank-based nonparametric test were completed on the survey data with initial reliability

analysis that satisfied Cronbach's α where $\alpha \geq 0.7$ showed intercorrelation for each question (Knoke et al., 2002). Questions that fall below the satisfied α value will be reported as proportion and discussed further in the discussion. Section B and Section C were run simultaneously for reliability test with Cronbach's α test and α value was 0.74 and 0.67. Descriptive statistics (Table 2) were used to determine frequency distribution for items within questions. Mean between dependent variable (knowledge and attitude score) and independent variable, referring to the sociodemographic factors were compared for any significant differences. Eventually, a post hoc test was run to differentiate the items that are statistically significant.

4.1 Socio-demographic characteristics of the study respondents

Selangor dairy cattle veterinary personnel reported participation according to district with a majority from Petaling (11/19, 58%) followed by Sepang (3/19, 16%) and 5% (1/19) each for Kuala Langat, Hulu Selangor, Kuala Selangor, Klang and Sabak Bernam. However, no participation was observed from Gombak and Hulu Langat (Figure 1). Distribution between both male and female respondents showed more male respondents compared to female with 57.9% (11/19) and 42.1% (8/19) respectively. Most of the personnel taking part for the survey aged 30-49 years old (13/19, 68.42%) while 5.26% (1/19) aged more than 50 years old and the rest were less than 30 years old. Majority of the respondents had a diploma qualification (8/19, 42.1%) while 31.58% (6/19) of the respondents graduated with a degree of veterinary medicine (DVM). Overall, they were associated with mixed practices (13/9, 68.42%) and only 31.58% (6/19) of the respondents worked with only bovine species. Thirteen out of eighteen respondents (13/9,

68.42%) spent 1-3 hours with cases or animals per working days and 2-3 days (10/19, 52.6%) is the most frequent number of working days per week for the respondents.

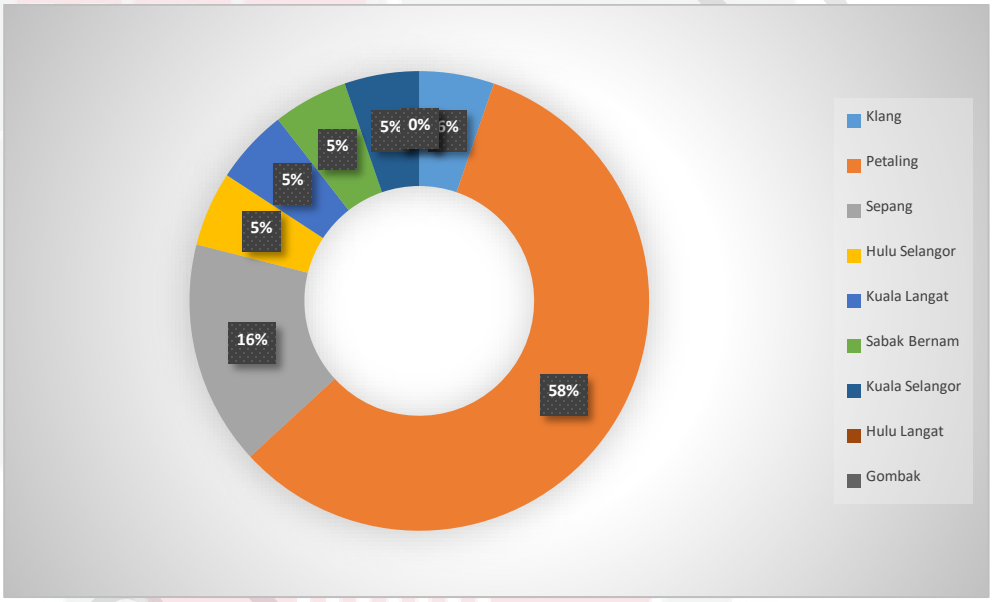

Figure 1: Distribution of the respondents according to districts

Variables		Frequency (n)	Percentage (%)
Gender	Male	11/19	57.90
	Female	8/19	42.10
Age	< 30 year-old	5/19	26.32
	30-49 year-old	13/19	68.42
	> 50 year-old	1/19	5.26
Educational qualification	SPM	5/19	26.32
	Diploma	8/19	42.10
	DVM	6/19	31.58
	Postgraduates	0/19	0
Species frequently attended	Bovine	6/19	31.58
	Caprine	0/19	0
	Ovine	0/19	0
	Mix	13/19	68.42
Frequency attending cases	Once a week	6/19	31.58
	2-3 days per week	10/19	52.63
	4-6 days per week	1/19	5.26
	Everyday	2/19	10.53
Time allocated in contact with animals or treatment	< 1 hour per day	3/19	15.79
	2-4 hours per day	13/9	68.42
	4-6 hours per day	2/19	10.53
	> 6 hours per day	1/19	5.26
Years of working	< 3 years	5/19	26.32
	4-8 years	7/19	36.84
	9-13 years	4/19	21.05
	>13 years	3/19	15.79

Table 2: Socio-demographics of the respondents

4.2 Knowledge regarding udder health management

Veterinary-related personnel in Selangor obtained a mean score of 8.0 ± 0.88 (SD). Respondents agreed that they have heard of term udder health before with 19 out of 19 (100%) respondents answered 'Yes'. The following questions focused on epidemiology and disease management involving udder diseases and the responses were tabulated in Microsoft Excel (2013) and scored accordingly with 'Yes' as 1 and 'No' as 0. Knowledge section contained 10 questions and highest score would be 10. Socio-demographic factors involving gender, age groups, educational qualification, species attended, frequency attending cases per week, time allocated when attending cases and years of working were tabulated accordingly and compared for mean between each socio-demographic factors and knowledge score. Questions selected for this section served as basic items for knowledge in udder health and score of 10 would be regard as Good Knowledge meanwhile 9 and below as Poor Knowledge. Knowledge score is being categorised into two groups (Good, Poor) and it was observed that only one respondent with Good Knowledge (1/19, 5.26%) and the rest with Poor Knowledge. Categorical outcomes require nonparametric tests hence the data was computed and tested for Kruskal-Wallis H Independent Sample in two or more variables. Mean for knowledge score and each personal factors were compared by using Kruskal-Wallis H test and educational qualification was observed significantly different. Knowledge score between different educational qualification, $p = 0.022$ ($p<0.05$), with a mean rank knowledge score of 12.80 for SPM, 6.25 for Diploma, 11.40 for DVM. Post-hoc test (Dunn's test with Bonferroni correction) was run for pairwise comparison between each educational qualification

however no significant difference of knowledge score was observed between DVM-Diploma, DVM-SPM or Diploma-SPM group.

4.3 Attitude toward udder health management

This section focused more on the approach of veterinary-related personnel in Selangor on treatment plan and decision for udder diseases. Four 'Yes' or 'No' questions and 6 statements were used to score each respondent for their answers. Two questions specify on their following up period for cases and frequency of cases reported by farmers related to udder diseases and were discussed as frequencies. Mean for attitude score among veterinary-related personnel was 8.1 ± 1.05 (SD). Likelihood in deciding treatment plan for veterinary-personnel are showed in Figure 2, 3 & 4. More than half of the personnel agreed to avoid dispensing antibiotics for every case associated with udder diseases meanwhile 14 out of 19 (73.68%) respondents agreed to use anti-inflammatory for each treatment involving udder diseases. Only one respondent concurred that detection of aetiological agents prior to antimicrobial therapy is not required. Ninety percent (90%) of the participants agreed that it is important to educate farmers on isolation of animals with udder disease from unaffected herd. Total score for this section is 10 with the first four questions answered all correct by the respondents were considered as Good Attitude and seven out of nineteen respondents (7/19, 36.84%) were observed with Good Attitude. Kruskal-Wallis H independent test was used to analyse the significance of socio-demographics with the attitude score. Mean for attitude score and each factor were compared by using Kruskal-Wallis H test and educational qualification was found to be significantly different from other personal factors. Attitude score between different

educational qualification, $p = 0.028$ ($p<0.05$), with a mean rank attitude score of 4.60 for SPM, 11.88 for Diploma, 12.00 for DVM. Post-hoc test (Dunn's test with Bonferroni correction) was run for pairwise comparison between each educational qualification and attitude score. SPM-Diploma is significantly different compared to other pairs with $p=0.046$ ($p<0.05$). Factors in making decision for treatment plan were focused on three different group related to the working field, owners and general. Most respondents were more likely to treat the animals based on their working experience (15/19, 79%) and their certainty in diagnosing the disease (14/19, 74%). Four out of nineteen respondents (4/19, 21%) were less likely to consider cost factors in deciding on their treatment plan meanwhile only one respondent (1/19, 5%) regarded availability of drug choices in the farm to be least likely considered. The rest of the components shared quite fair distribution with 'More Likely' and 'Neutral'. Environment and housing, and herd health status were agreed by 58% (11/19) of the respondents that they gave higher probability in making treatment decision.

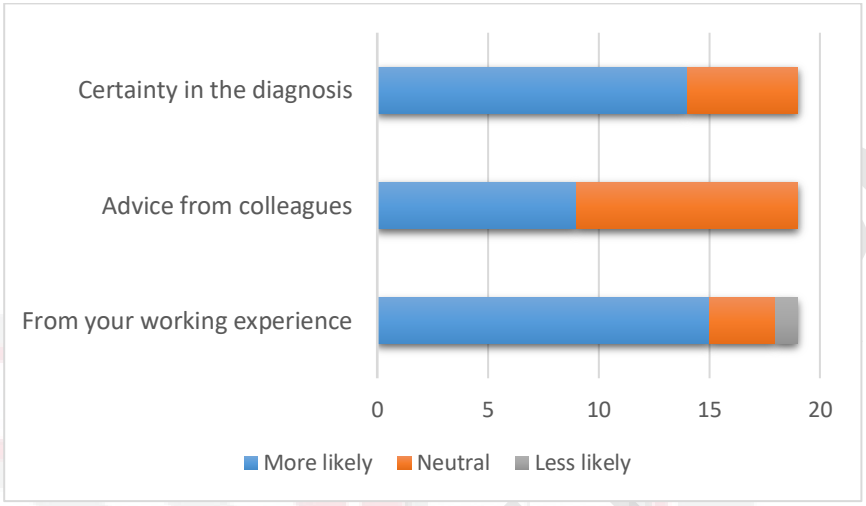

Figure 2: Responses on factor relating to working field in deciding treatment plan for udder diseases

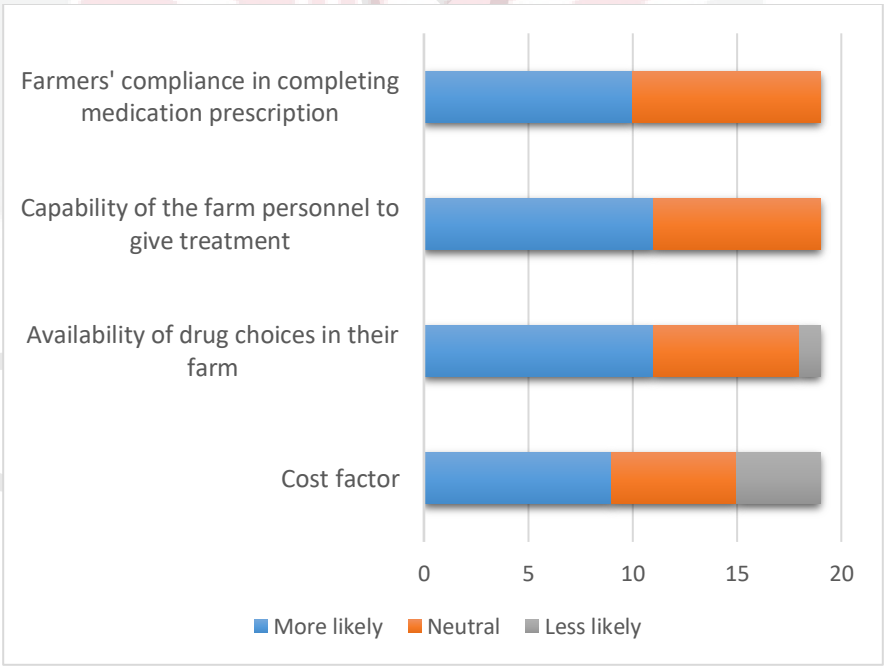

Figure 3: Responses on factor relating to the owner in deciding treatment plan for udder diseases

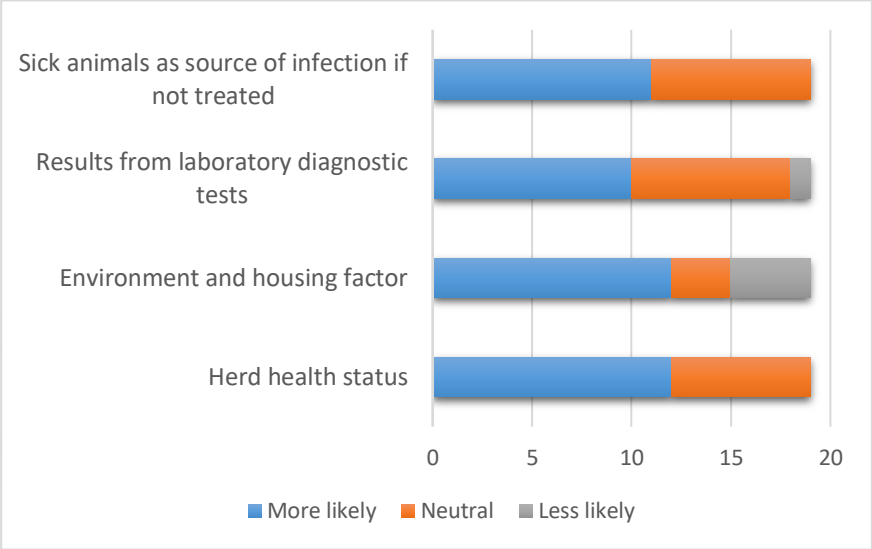

Figure 4: Responses on factor relating to general in deciding treatment plan for udder diseases

4.4 Source of information

Source of information regarding udder health management were answered as multiple responses and each of the respondents' answer was recorded in Table 3 in which the frequency of source of information referred by the respondents for each item were reported. Peer and formal training were observed as two top sources of information referred by the veterinary-related personnel with 78.90% (15/190, 73.70 (14/15) % respectively. Social media was the least preferred source with 15.80% (3/19) participation.

	Frequency (n)	Percentage (%)
Website	12/19	63.20
Social media	3/19	15.80
Textbook	7/19	36.80
Scientific articles	9/19	47.40
Peers	14/19	73.70
Formal training	15/19	78.90

Table 3: Source of information selected by respondents

4.5 Monitoring treatment outcome and frequency of udder diseases complaints from farmers

Majority of the participants (13/19, 68.40) would be monitoring outcome following treatment given for udder diseases in less than 2 weeks meanwhile two respondents (2/19, 10.50%) never followed up their treatment outcome.

	Frequency (n)	Percentage (%)
< 2 weeks	13/19	68.40
2-4 weeks	3/19	15.80
4-6 weeks	1/19	5.30
Never	2/19	10.50

Table 4: Time frame in monitoring treatment outcome

Most common method used to monitor their treatment outcome was farm visits where fifteen out of nineteen (15/19, 78.90%) respondents were recorded. Only one respondent (1/19, 5.26%) provided other method to monitor treatment outcome which is through milk production record and one respondent (1/19, 5.26%) answered 'None'.

	Frequency (n)	Percentage (%)
Farm visits	15/19	78.90
Phone calls	9/19	15.80
Farm record on diseases	8/19	47.40
Others: Milk production record	1/19	5.26
None	1/19	5.26

Table 5: Method in monitoring treatment outcome

Frequencies of udder diseases complaints received by veterinary-related personnel in Selangor from the farmers was primarily in once a month time (10/19, 52.60%) and only one respondent (1/19, 5.26%) received complaints in 2-3 times per week as shown in Figure 5.

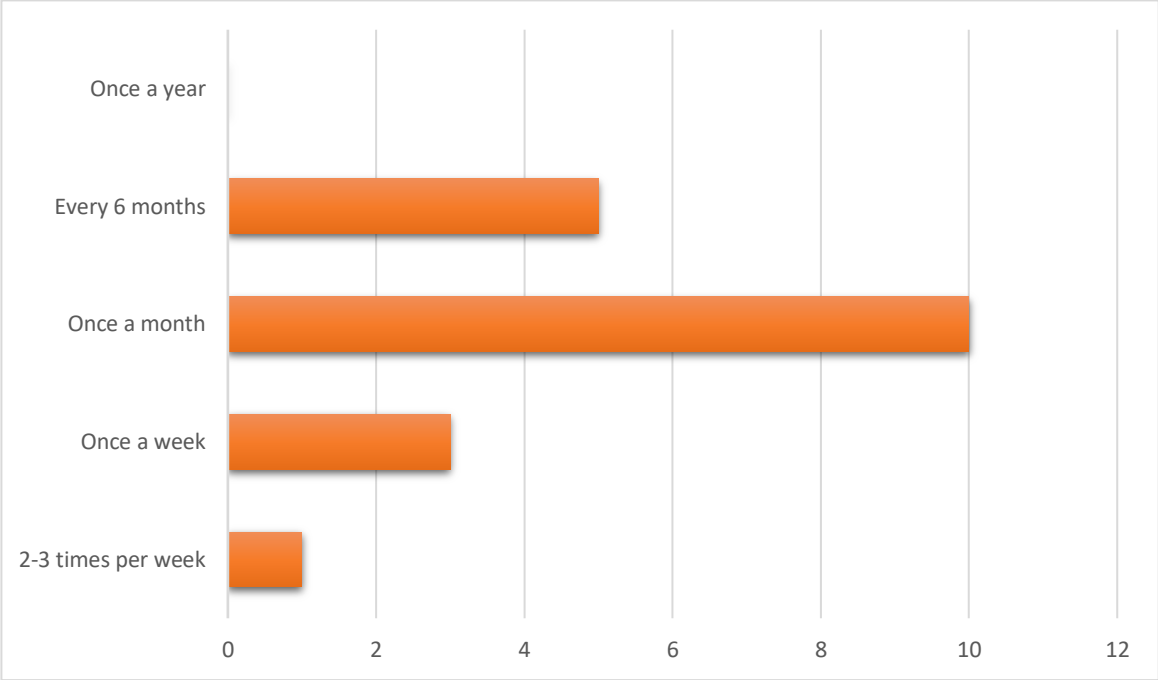

Figure 5: Frequency of udder disease cases complained by the farmers

It was observed that the farmers received educational tools related to udder health management in which practical guide on udder health being provided the most with 57.90% (11/19), followed by illustrated fact sheet on California Mastitis Test (CMT) and clinical mastitis treatment protocol with 47.40% (9/19) meanwhile four respondents (4/19, 21.20%) did not provide any of the listed tools to the farmers. The rest of the educational tools provided to the farmers were shown as below in Table 6.

	Frequency (n)	Percentage (%)
Illustrated fact sheet on California Mastitis Test (CMT)	5/19	26.30
Teat condition assessment form	7/19	36.80
Illustrated fact sheet on milking procedures and teat condition	9/19	47.40
Udder health objectives (flyer)	5/19	26.30
Practical guide on udder health	11/19	57.90
Illustrated fact sheet of milk sampling technique	4/19	21.10
Illustrated fact sheet of injection technique in dairy cows	2/19	10.50
Mastitis Cost Calculators	2/19	10.50
Clinical mastitis treatment protocol	9/19	47.40
None	4/19	21.10

Table 6: Educational tools provided to the farmers

4.6 Udder health recommended strategies

Responses collected on recommended udder health improvement involving milking hygiene (Figure 6) observed that ‘wearing milking gloves, washing hands between milking, or both can reduce mastitis incidence’ received the greatest number of

respondents (11/19, 57.90%) as ‘strongly agree’ with the approach. Strong disagreement in ‘leaving cows to stand 30 minutes after milking’ and ‘cleaning dip cup at least every 2 days and renewing the solution after use on maximum of three cows for each milking session’ were noticed in the responses both with 5.26% (1/19). Three out nineteen of the respondents (3/19, 15.80%) slightly disagreed that ‘every cow should be provided with their own udder cloths or single-used paper towel’ and one of them (1/19, 5.26%) indicated the same for ‘application of post-milking topical cream on the teat’. In improving udder health by strategizing the milking equipment (Figure 7), majority of the respondents strongly agreed on providing recommendation on washing routine of milking machine to the farmers with 94.50% (18/19) responses meanwhile one of the respondents (1/19, 5.26%) strongly disagree on vitality of acid wash descale to be perform on weekly basis. Recommendation on environment/housing (Figure 8) strategy on the other hand reported the highest frequency with ‘optimise cubicle hygiene by avoid wetting the floor and applying disinfectant regularly’ by eleven out of nineteen respondents (11/19, 57.90%). Strong disagreement was seen in one of the respondents (1/19, 5.26%) regarding ‘width and length of the lying space for each cow’.

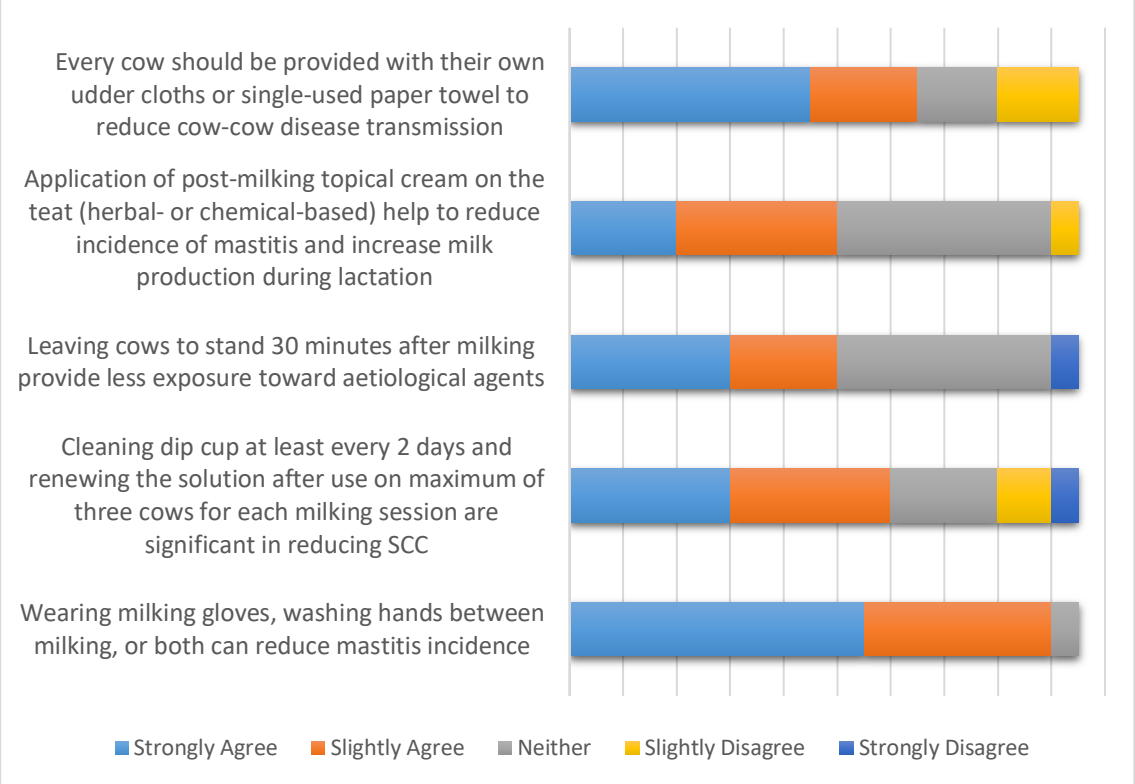

Figure 6: Responses on milking hygiene strategies in improving udder health

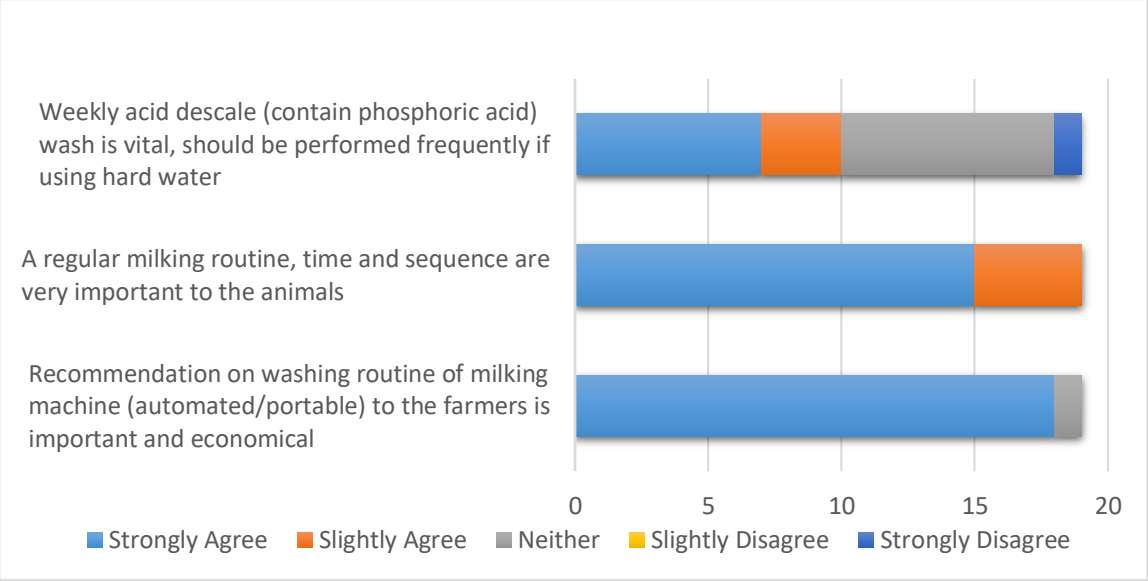

Figure 7: Responses on milking equipment strategies in improving udder health

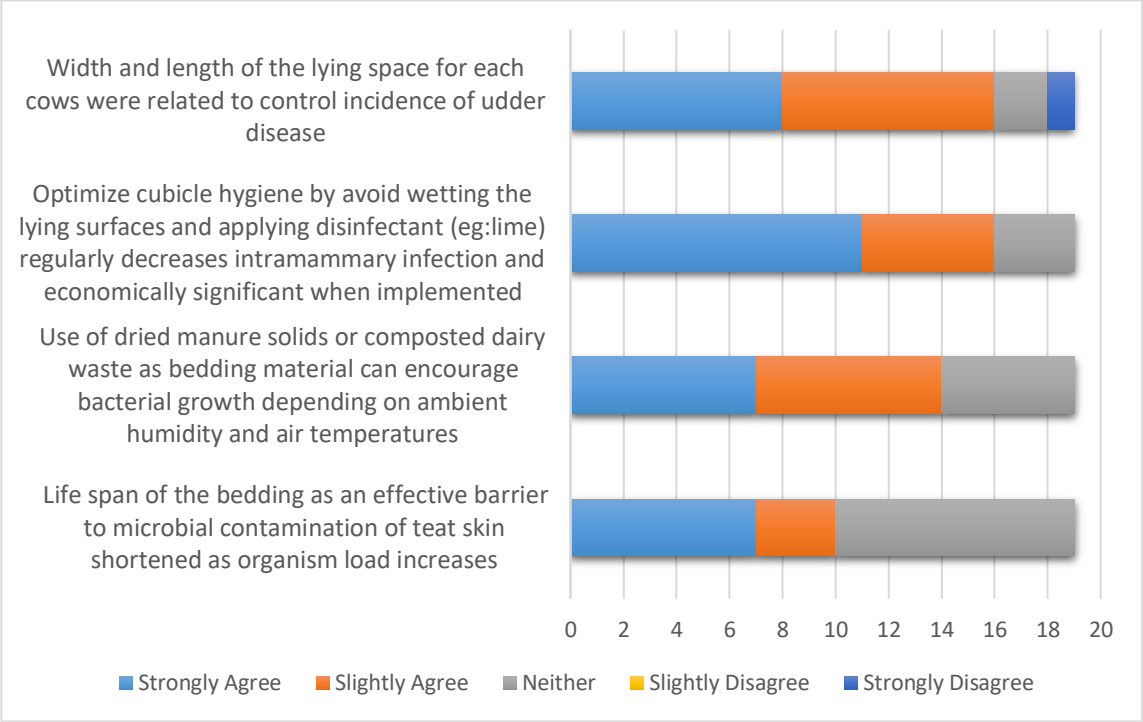

Figure 8: Responses on environment/housing strategies in improving udder health

4.7 Agreement on common statement from literature pertaining to dairy industry

Responses of the participants were collected on three common statement often reported in literature (Huijps et al., 2010; Kivaria & Noordhuizen, 2007; Nickerson & Rayman, 2019). First statement where 'maintaining udder health management are often frustrating among farmers' recorded slight disagreement from the respondents by 15.79% (3/19) meanwhile 36.84% (7/19) disagreed that 'automated milking is the main cause for udder disease in dairy industry. Last question of the section which was 'Udder diseases as the main reason for use of antibiotics in dairy production system' observed only one respondent (1/19, 5.26%) disagreed.

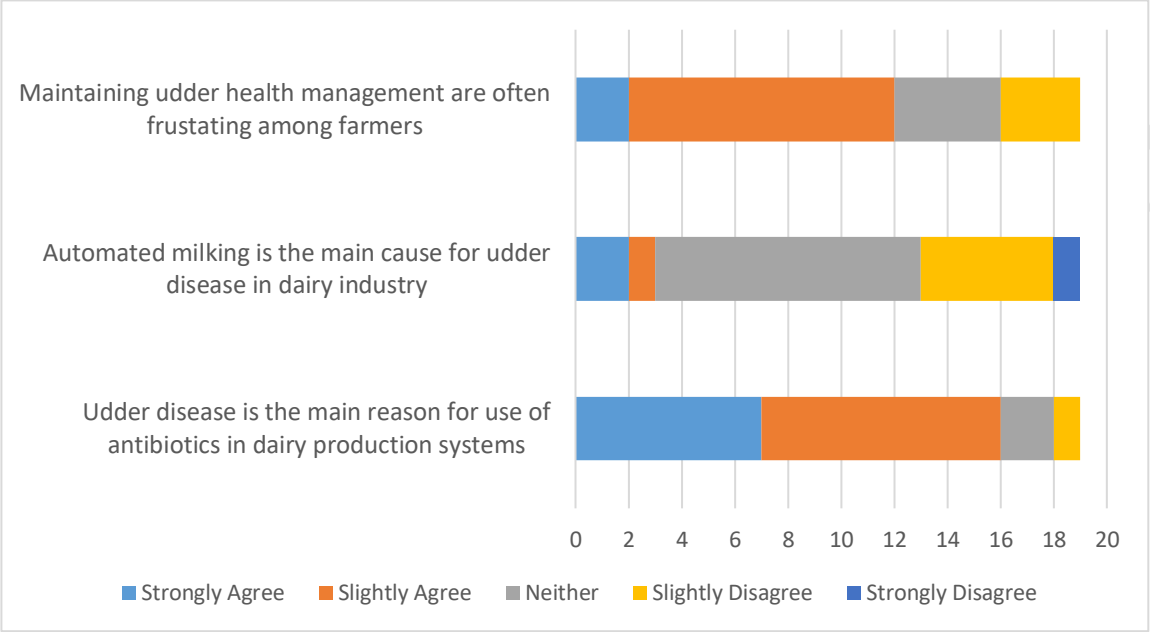

Figure 9: Responses on common statements in literatures pertaining to dairy industry

4.8 Association between Knowledge score and Attitude score

Knowledge score and attitude score obtained for each respondent were tested for association with Chi-Square test, for qualitative variables. The association was observed as significant with $p=0.006$ ($p<0.05$). However, association tested for each personal factor in relation to knowledge and attitude score had no significant finding.

5.0 DISCUSSION

5.1 Importance of perception and understanding in udder health management

An approach as a whole is needed when it comes to livestock management. In order to execute effective udder health strategies, perception of dairy cattle practitioners and their understanding towards udder diseases and udder health are crucial in delivering

information and motivation to the farmers regardless of their farm objectives. Multiple literatures on udder diseases, udder health and strategies in improving udder health focused on the farmers with a very limited studies concentrated on dairy cattle practitioners. Hence, a survey on knowledge and attitude towards udder health management was deem justified with farmers' complaint in difficulty obtaining professionals advisory and consult for their livestock management.

Measurement of effectiveness of common management practices in dairy farms through instruments developed based on theoretical studies has not yet been proven in term of mastitis prevention and control and may pose as challenge in determining appropriate management practices for each farm (Dufour et al., 2010). Understanding of veterinary-related personnel is important when it comes to udder health management as study by Lam et al., (2007) reported that knowledge when implemented at practice level, can significantly improve udder health. The five and ten points of mastitis control plans suggested by National Mastitis Council, USA (NMC) were considered as crucial criteria in evaluating level of knowledge of these personnel as it promotes information and research for udder health, milking management, milk quality and milk safety. Furthermore, 5-point mastitis control plan was designed based on the extensive efforts by the veterinarians throughout the dairy industry (Leblanc et al., 2006). Up until now, validity of NMC plan remains applicable for good udder health (Hillerton & Booth, 2018) where information exchange is a major component in NMC mission and has a long history of generating educational materials (Middleton et al., 2014). Poor attitude level among the personnel was observed where 89% of the respondents lost their score in treatment

and outcome in managing udder health. They agreed to use anti-inflammatory and antibiotic for every udder disease they encounter. Their treatment plans should be justified and monitored due to the finding that decision-making by farmers regarding treatment are influenced by their veterinarians. Moreover, it is observed in local setting that officers involved directly with the farmers were not all with minimum qualification as a veterinarian thus depth of their understanding play important part in managing udder health and this scenario was seen in many part of the world where veterinarians workmanship becoming very costly especially with task that can be done by others as well (Lam et al., 2011). In short, farmers opted to use cheaper workers. According to Nägele et al. (2019), good udder health is achievable with low antibiotic usage whereby usage of antibiotic for every udder diseases could lead to antimicrobial resistant. Meanwhile, increased rumen motility and decreased rectal temperature were observed in non-severe mastitis cases when treating case without indication for anti-inflammatory (Wagner & Apley, 2003).

5.2 Communication and knowledge transfer from professional to dairy farmers

Communication and advocacy status between practitioners and dairy cattle farmers were evaluated through degree of educational tools provided and implementation of the instruments to the dairy farmers. Engagement of the professionals will increase level of acceptance of the farmers toward advices and proposed management strategies to be implemented in their farm practice as reported by Derks et al. (2013) and Sorge et al. (2010). On the other hand, veterinarian and government body were regarded as important cause in promoting successful udder health programme (Jansen et al., 2010). Source of

information referred by these veterinary-related personnel for udder health management were obtained with majority of them relying on formal training and peers. Choices made by the personnel were supported by literatures that provision of training is as common idea to address knowledge (Cattaneo et al., 2009). On the other hand, knowledge and experience sharing with peers of the same goals can influence positive attitude (Armitage & Conner, 2010). It was observed that not all personnel provide educational tools on components of udder health management to the farmers and according to Falkenberg et al. (2019), it was observed in German dairy farmers whom did not make use of educational tools and information provided given, were likely to experience a sudden event of infection with the udder without known reasons. Furthermore, farmers were observed to benefit from educational tools when they were motivated to implement the instruments given with understanding of the importance in improving udder vigour, positive economical outcomes and demand to be ahead with updated information on udder health (Jansen et al., 2010). In this study, association of knowledge and attitude with the socio-demographic factors were not proven through statistical analysis despite finding that educational programmes can improve knowledge, skills and attitude (McNamara et al., 2012) as well as longer experience and more case handled, practitioners are observed to manage cases better at herd level (Persson Waller et al., 2016). Factors such as unbalanced sample size and small size of the sample population were seen with poor performance in statistical test (Alamolhoda et al., 2017) where it can contribute to insignificant statistical result. Besides, absence of benchmarks referring to previous study that had been done in the same topic, can lead to difficulty in obtaining and determining

reliability of the results where comparison of the study data is not possible. A study by Kilale (2016), showed that knowledge, attitude and practice studies were more useful in evaluating intervention program or program planning rather than describing a population. The survey was conducted without prior to any of the educational program or training related to this particular topic.

5.3 Udder health recommended strategies

According to Barkema et al. (1999), strategic and precise efforts over times showed improvement in udder health. Improving udder health is achievable by mastering each of the components involved in the udder health pyramid as suggested by (Landin et al., n.d.) and management areas involved dependent on the causative factors of udder diseases in their farms as shown in Figure 9. Categorisation of recommended strategies were selected according to content discussed in a study by Tschopp et al. (2015), which include milking hygiene, milking machine, environment or housing, dry period or other. However, findings from this study showed farmers implemented more significantly in these two topics compared to the rest of the topics hence only components in topic milking hygiene and environment or housing were added in the questionnaire with five and four strategies respectively. Strategy by leaving cows to stand 30 minutes after milking was observed with one of the respondents disagreed (1/19, 5.26%). It was reported that intramammary infection risk is the highest in period immediately and within 30 minutes post milking. Meanwhile, cleaning dip cup at least every 2 days and renewing the solution after use on maximum of three cows for each milking session was also seen with disagreement where the expense entailed by such restriction might inhibit adoption of a management practice

(Schultze & Smith, 1972). In environment or housing factor, the only strategy involving width and length of lying space for each cows was related to control incidence of udder disease showed one disagreement from the respondents. Standard dimensions for the cows were dependent on body weight and size (DairyCo, 2012) where lying places larger than standard dimensions had more mastitis quarters with higher risk of dirtying udders (Ivemeyer et al., 2011).

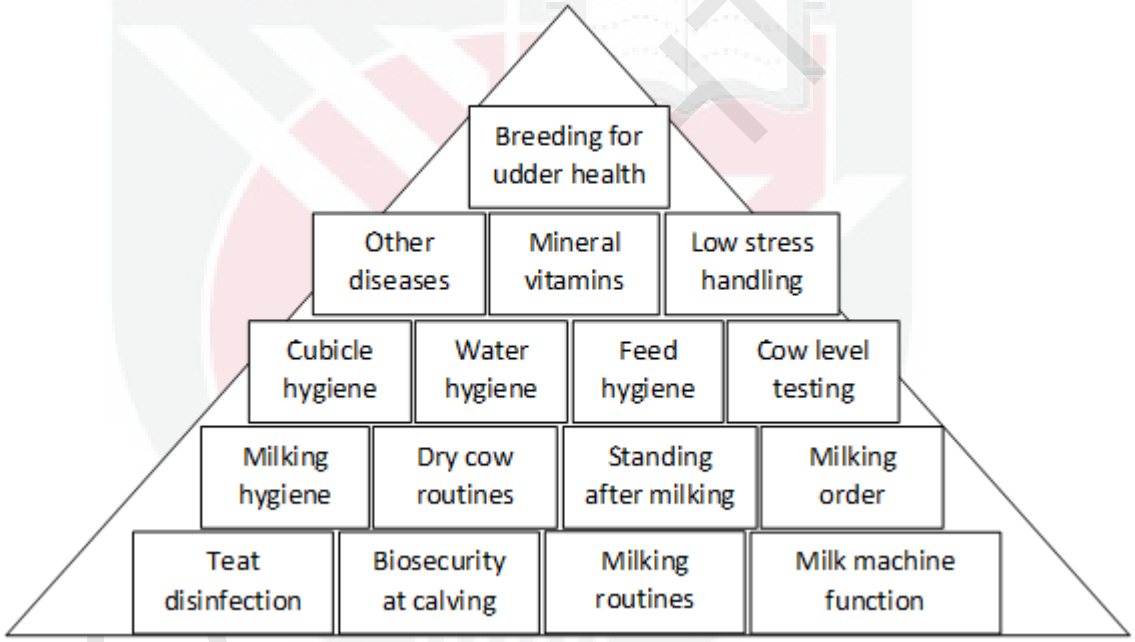

Figure 10: Udder health pyramid

5.4 Principle of treatment for udder diseases

Factors in deciding treatment were categorised into three which are related to the working field, owners and general. This study found that the personnel relied on their certainty in diagnosis and working experience the most when deciding on treatment. The findings were in accordance with literature that through psychological perspective, past

experiences included when it comes to decision-making (Fraser, 2019) and making medical decision is important to be accompanied with confidence and diagnostic certainty (Hausmann et al., 2019). Monitoring of treatment was also analysed with components including method in monitoring, frequency in monitoring treatment outcomes and frequency cases reported by local farmers to the veterinary-personnel. In monitoring treatment outcome, follow-up is important to evaluate the effectiveness of treatment given (Persson Waller et al., 2016). Majority of the respondents follow-up the treatment in less than 2 weeks and the time window was seen lesser than the one suggested by Nickerson & Rayman (2019) where clinical signs recovery can be seen in 24-48 hours, however clinical cure can only be determine within 20 days. It is particularly important to ensure whether the disease reoccur or a new infection is taking place. Meanwhile, method used by the respondents to monitor their treatment were majority through farm visits. Assessment of clinical signs shown by the animals was the common way to determine whether treatment given is working or not (Persson Waller et al., 2016). Other method suggested by one of the respondent was milk production record where it was stated by Gussmann et al. (2018), increased milk production is likely to indicate a need for treatment. On the other hand, frequency of udder diseases cases reported by the farmers was also surveyed and case reported once a month dominated the other choices given. It is suggested that prevalence of clinical mastitis average 20-25 cases per year in 100-cows (Nickerson & Rayman, 2019). However, prevalence of clinical mastitis average cannot be calculated in this study due to absence of total animal population for the reported cases by the farmers. Moreover, it is important to emphasise that the number of cases reported

may be inaccurate due to lack of understanding in udder health among farmers where they hardly seek for veterinarian help and tend to opt for a rather discouraging decision in managing milk issues (Lam et al., 2011; Leblanc et al., 2006). It has been extensively discussed in a study that it is the most frequent practice done by the farmers are by culling the affected animals and they should be made aware that the method only work temporarily and not feasible in a long run (Shock et al., 2020).

5.5 Perception of veterinary-related personnel in dairy cattle industry in Selangor

Perception of the veterinary-related personnel was observed from common statements related to dairy cattle industry worldwide. The first statement on 'maintaining udder health management' was found to be often frustrating among farmers. It was observed that some of the respondents disagreed with the statement. According to Sorge et al. (2010), such result may be due to different social interaction styles since they are associated level of compliance among farmers. Statement on 'automated milking' as the main cause for udder diseases in dairy industry had disagreement from six respondents even though evidence of damage from machine milking is clear and can be observed through examination of the teats of most herds (Reinemann, 2018). This situation may not be observed in local setting because 85% dairy farmers are smallholder with less than 30 animals (Suntharalingam & Ahmad, 2015). The third statement stated that 'udder disease is the main reason for use of antibiotics in dairy production system' had one of the respondents disagreed. According to previous studies, mastitis and antibiotic in dry cow treatments were the most common causes of antimicrobial consumption (Nägele et al., 2019; Ruegg, 2012).

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

Study involving veterinary-related personnel in Selangor toward this particular topic has not being done before and this is the first study in the region to report the knowledge and attitude of the personnel toward udder health management. In conclusion, veterinary-related personnel in Selangor had an unsatisfactory level of knowledge and attitude pertaining to the topic. This was supported in their scores of basic criterion for both knowledge and attitude in udder health and its management. Majority of the personnel agreed to monitor their treatment and provide educational tools to the farmers which can improve communication and knowledge transfer between the professionals and dairy farmers in managing udder health. However, true representation of current practice cannot be determined from this study due to several limitation of the study. Construction of the instrument used did not measure knowledge and attitude of the respondents in depth and a suitable method should be deployed to ensure each respondent have the same understanding for every questions.

6.2 Recommendation

In the future, we would like to recommend on improving the quality of the instrument used whether by improving questions specificity or to use a qualitative study design as an option. Suggested qualitative methods such as interviews or observation can be used in this study. Besides, study population use in this study can be expanded into a variety of target groups such as private dairy cattle practitioners and dairy farmers in Selangor. The study should also include inter-personal skills building as to observe

growth of the respondents in this particular topic by assessing the continuous educational program organised by the relevant parties.

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APPENDICES

Appendix A – Questionnaire

SURVEY ON KNOWLEDGE AND ATTITUDE AMONG VETERINARY-RELATED PERSONNEL TOWARDS DAIRY CATTLE UDDER HEALTH MANAGEMENT IN SELANGOR, MALAYSIA.

Description:

1. This Questionnaire Comprised Of **4 Sections**

2. The Sections Are:

Section A: Socio-demographic and general questions

Section B: Knowledge about Udder Health

Section C: Attitude towards Udder Health Management and Diseases

Section D: Monitoring on Udder Health Management

* All information and collected data for the questionnaires will be kept confidential and the respondent will remain anonymous for confidentiality assurance.

SURVEY ON KNOWLEDGE AND ATTITUDE TOWARDS DAIRY CATTLE UDDER HEALTH MANAGEMENT AMONG VETERINARY-RELATED PERSONNEL IN SELANGOR, MALAYSIA.

Dear Respondent,

You are invited to participate in a study being conducted by a final year student of Doctor of Veterinary Medicine (DVM), Universiti Putra Malaysia. This study will serve as a pilot study to assess the practice on udder health management among veterinarians or veterinary-related personnel in Selangor and to evaluate their understanding toward the importance of udder health management.

Mastitis remains one of the most common and costly dairy industries and udder health can be improved through implementation of best management practices. Such practices include wearing gloves at the time of milking, using individual towels to wipe the udders and using a post-milking teat disinfectant are associated with lower intramammary infection rates. Many countries have implemented different strategies and recommendations to control mastitis that requires effective communication between veterinary-related personnel by providing advice in herd and udder health management is important in making sure farmers are motivated to change their behaviour towards better udder health management practices. Though many researches have looked at the personalities, attitudes and motivations of the farmers in influencing their farm and udder health management, none of these studies focused on assessing the level of knowledge and attitude toward udder health management among veterinary-related personnel. This information may help in developing and improving their communication skills to suit their advisory role and facilitating client behaviour change.

To achieve the objectives of this study, your participation is much appreciated. Your responses will be confidential and no other people will know your individual answers to this questionnaire. If you agree to participate in this project, please answer the questions on the questionnaires as best you can. Please return the questionnaire as soon as possible to the student in-charge. If you have any question about this study, feel free to contact the student or supervisor at contact information.

Thank you for your assistance in this important endeavour.

Best regards,

……
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……
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A. Socio-demographics and general questions

1. District:
   _____

2. Gender
   ○ Male ○ Female

3. Age
   ○ < 30 ○ 30-49 ○ ≥50

4. Highest educational qualification
   - ○ SPM
   - ○ Diploma
   - ○ DVM
   - ○ Post graduates
   - ○ Others:……..

5. Species of ruminants frequently attended to?
   - ○ Bovine
   - ○ Caprine
   - ○ Ovine
   - ○ Mix

6. Time allocated to treatment or contact with per working days?
   - ○ Less than 1 hour
   - ○ 1-3 hours
   - ○ 4-6 hours
   - ○ Above 6 hours

7. Years of working experience
   - ○ < 3 years
   - ○ 4-8 years
   - ○ 9-13 years
   - ○ > 13 years

8. Source of information for udder health management?

- Website
- Social media
- Textbook
- Scientific article
- Peers

B. Knowledge About Udder Health

9. Have you heard of 'udder health' before?
   ○ Yes ○ No
10. Is udder health management an important indicator for farm performance rate?
   ○ Yes ○ No
11. Do you know common diseases affecting udder in ruminants?
   ○ Yes ○ No
12. Would you be able to identify clinical signs in animal with udder diseases?
   ○ Yes ○ No
13. Is it okay to start treatment promptly when animal shows clinical signs related to udder diseases?
   ○ Yes ○ No
14. Do you think that type of farm management influence udder diseases incidences?
   ○ Yes ○ No
15. Are you aware of common aetiological agents in udder diseases?
   ○ Yes ○ No
16. Do you think animal with udder disease should be isolated from healthy group?
   ○ Yes ○ No
17. Are you familiar with 5-basic points and 10-basic points of National Mastitis Council?
   ○ Yes ○ No
18. Do you know differences between 10-basic points and 5-basic points of National Mastitis Council?
   ○ Yes ○ No

C. Attitude Towards Udder Health Management and Diseases

19. Would you dispense antibiotics for every udder diseases?
   ○ Yes ○ No
20. Do you agree that anti-inflammatory is required in every treatment of udder diseases?
   ○ Yes ○ No
21. Should you identify etiological agents causing udder diseases prior to initiating a therapy?
   ○ Yes ○ No
22. Is it important to educate the farmers to isolate animals with udder disease from the rest of the herd?

○ Yes ○ No

23. Please indicate if the following statements are 'true' or 'false'.

No.	Statement	True	False
1.	Same medication should be prescribed to different animals with udder diseases in the same herd.		
2.	Improvement of milk quality are primarily related to farmers' compliance and udder health implementation rather than to lack of technical knowledge or skills		
3.	Drying off dairy cows with antimicrobials has an effect on udder health, antimicrobial usage, and economics.		
4.	Most farmers liked being informed about the latest developments in udder health management.		
5.	Most farmers think that udder diseases are least important diseases compared to other diseases/issues in the farm		
7.	Three factors that would motivate farmers to improve udder health include pride and satisfaction to a job well done, healthy animals as a result of less mastitis incidences and the influence of their peers and education.		

D. Monitoring of udder health management

24. Have you provide any of the following educational tools to the farmers? *(you may choose more than one answer)*
    ○ Illustrated fact sheet of California Mastitis Test
    ○ Teat condition assessment form
    ○ Illustrated fact sheet on milking procedures and teat condition
    ○ Flyers on udder health objectives
    ○ Practical guide on udder health
    ○ Illustrated fact sheet on milk sampling technique
    ○ Illustrated fact sheet on injection technique in dairy cows/ewes
    ○ Mastitis Cost Calculators
    ○ Clinical mastitis treatment protocol

25. How would you monitor your treatment outcomes for each farmer(s)? *(you may choose more than one answer)*
    ○ Farm visits
    ○ Phone calls
    ○ Farm records on disease incidences
    ○ Others, please specify _____

○ None of above

26. How often would you follow up your treatment outcomes for every farms?
    ○ < 1 week
    ○ 2-3 weeks
    ○ 4-6 weeks
    ○ Never

27. How frequent do you receive complaints from farmers predominantly on udder disease?
    ○ 2-3 times per week
    ○ Once a week
    ○ Every month
    ○ Every 6 months
    ○ Once a year

28. Factors influencing veterinary-related personnel decision in udder diseases treatment

	Items	Less likely	Neutral	More likely
	Relating to working field			
1.	From your working experience			
2.	Advice from colleagues			
3.	Certainty in the diagnosis			
	Relating to the owner			
4.	Cost factor			
5.	Availability of drug choices in their farm			
6.	Capability of the farm personnel to give treatment			
7.	Farmers' compliance in completing medication prescription.			
	General			
8.	Herd health status			
9.	Results from laboratory diagnostic tests			
10.	Environment and housing factor			
11.	Increase in number of sick animal if not treated			

29. On the scale shown, how much do you agree the following strategy would help to improve udder health?

A	Milking hygiene	**Strongly Agree**	**Slightly Agree**	**Neither Agree nor Disagree**	**Slightly Disagree**	**Strongly Disagree**
1.	Wearing gloves during milking, washing hands between milking, or both can reduce mastitis incidence	5	4	3	2	1
2.	Cleaning dip cup at least every 2 days and renewing the solution after use on maximum of three cows are significant in reducing SCC.	5	4	3	2	1
3.	Leaving cows to stand for 30 min after milking provide less exposure toward etiological agents	5	4	3	2	1
4.	Application of topical post-milking teat disinfection (herbal based or chemical antiseptic) lead to reduce in incidences of mastitis and increase milk production during lactation.	5	4	3	2	1
5.	Every cow should be provided with their own udder cloths or single-used paper towel to reduce cow-cow disease transmission.	5	4	3	2	1
B	Milking equipment	**Strongly agree**	**Slightly Agree**	**Neither Agree nor**	**Slightly Disagree**	**Strongly Disagree**
1.	Cleaning with alkaline detergent every day and with acid detergent at least once per week to reduce individual-individual udder disease incidences	5	4	3	2	1
2.	A persistent routine is very important during milking the animals	5	4	3	2	1
3.	Use a separate milking unit for fresh lactating cows.	5	4	3	2	1

C	Environment and housing	**Strongly Agree**	**Slightly Agree**	**Neither Agree nor Disagree**	**Slightly Disagree**	**Strongly Disagree**
1.	Life span of the bedding as an effective barrier to microbial contamination of teat skin shortened as organism load increases.	5	4	3	2	1
2.	Use of dried manure solids or composted dairy waste as bedding material can encourage bacterial growth depending on ambient humidity and air temperatures.	5	4	3	2	1
3.	Optimize cubicle hygiene by avoid wetting the lying surfaces and applying disinfectant (eg:lime) regularly decreases intramammary infection and economically significant when implemented	5	4	3	2	1
4.	Width and length of the lying space for each cows were related to control incidence of udder disease.	5	4	3	2	1

30. On the scale shown, how much do you agree with the following statement?

		Strongly Agree	**Slightly Agree**	**Neither Agree nor Disagree**	**Slightly Disagree**	**Strongly Disagree**
1.	Udder is the main reason for use of antibiotics in dairy production systems	5	4	3	2	1
2.	Automated milking is the main cause for udder disease in dairy industry.	5	4	3	2	1
3.	Maintaining udder health management are often frustrating among farmers.	5	4	3	2	1

-End of questionnaire

Appendix B

Test Statistics[a,b]

	Knowledge score
Kruskal-Wallis H	7.672
df	2
Asymp. Sig.	.022

a. Kruskal Wallis Test

b. Grouping Variable: Educational qualification

Table 7: Kruskal-Wallis H test between knowledge score and educational qualification

Test Statistics[a,b]

	Attitude score
Kruskal-Wallis H	7.161
df	2
Asymp. Sig.	.028

a. Kruskal Wallis Test

b. Grouping Variable: Educational qualification

Table 8: Kruskal-Wallis H test between attitude score and educational qualification

Sample1-Sample2	Statistic	Error	Statistic	Sig.	Adj.Sig
Diploma-DVM	-6.417	2.718	-2.361	.018	.055
Diploma-SPM	6.550	2.869	2.283	0.22	.067
DVM-SPM	.133	3.048	.044	0.965	1.000

Table 9: Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is $p<0.05$. Significance values have been adjusted by Bonferroni correction for multiple tests.

Sample1-Sample2	Statistic	Error	Statistic	Sig.	Adj.Sig
SPM-Diploma	-7.275	2.997	-2.427	.015	.046
SPM-DVM	-7.400	3.183	-2.325	0.20	.060
Diploma-DVM	-.125	2.839	-.044	.965	1.000

Table 10: Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is p<0.05. Significance values have been adjusted by Bonferroni correction for multiple tests.

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	8.647[a]	1	.003	.006	.006	
Continuity Correction[b]	6.046	1	.014			
Likelihood Ratio	9.309	1	.002	.013	.006	
Fisher's Exact Test				.006	.006	
Linear-by-Linear Association	8.192[c]	1	.004	.006	.006	.006
N of Valid Cases	19					

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.95.

b. Computed only for a 2x2 table

c. The standardized statistic is -2.862.

Table 11: Chi-square test for association between knowledge and attitude