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ORIGINAL ARTICLE

Predictors of knowledge, attitude and practice among seropositive leptospirosis cattle farmers in northeastern Malaysia

Aziah Daud[1]*, Ijlal Syamim Mohd Basri[1], Elyas Ahmad[1], Wan Mohd Zahiruddin Wan Mohammad[1], Nabilah Ismail[2] and Fairuz Amran[3]

[1]*Department of Community Medicine, School of Medical Sciences, Universiti Sains Malaysia Health Campus, Kota Bharu, Kelantan, Malaysia*
[2]*Department of Microbiology, School of Medical Sciences, Universiti Sains Malaysia Health Campus, Kota Bharu, Kelantan, Malaysia*
[3]*Infectious Disease Research Centre (IDRC), Institute for Medical Research (IMR), Kuala Lumpur, Malaysia*

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ABSTRACT

Introduction: Leptospirosis is a neglected re-emerging disease, with Kelantan being the leading state in Malaysia for its annual incidence. Among agricultural workers, cattle farmers significantly contribute to the high incidence in Kelantan. In 2018, a high seroprevalence of leptospirosis (72.5%) was reported among these farmers. Despite various studies on leptospirosis in Kelantan, none have focused on cattle farmers. This study aims to assess knowledge, attitudes, and practices (KAP) levels and identify associated factors among seropositive leptospirosis cattle farmers in Kelantan. **Methodology**: This cross-sectional study utilized an interviewer-guided validated questionnaire to collect data from all seropositive leptospirosis cattle farmers in Kelantan. A Likert scale was used to score KAP, with total scores converted to percentages. Descriptive analysis was performed using IBM SPSS version 24.0. **Result**: Most respondents (64.4%) demonstrated good knowledge of leptospirosis, yet only 38.4% had a satisfactory attitude, and a mere 16.4% practised satisfactory preventive measures. Not eating or drinking at the workplace was associated with good knowledge, satisfactory attitudes, and practices. Wearing rubber boots and experiencing rat infestation at the workplace were linked to good knowledge. Living more than 200 meters from a river correlated with satisfactory attitudes while increasing age was associated with better practices. Additionally, wearing rubber gloves was linked to satisfactory practices. **Conclusion**: Despite their good knowledge, respondents exhibited unsatisfactory attitudes and practices toward leptospirosis prevention. Future efforts should focus on improving attitudes and practices to enhance preventive measures against leptospirosis.

Corresponding author: *Professor Dr Aziah Daud (aziahkb@usm.my)*

1. INTRODUCTION

Leptospirosis is a re-emerging zoonotic disease with a significant health impact towards the human population across the globe [1]. It is caused by Gram-negative bacteria of the genus Leptospira. While it is present in wild animals, it is more commonly associated with domestic animals like pigs, rodents, dogs, and cattle. Additionally, once excreted in the urine of an infected host, the bacteria can survive in the environment for weeks to months [2]. Humans are incidental hosts, typically infected through contact with urine-contaminated environments [3].

Globally, most leptospirosis infections in humans were attributable to rodents, primarily due to direct or indirect contact with the contaminated urine of the infected animals [4; 5]. Annually, over one million cases occur globally, resulting in approximately 60,000 deaths [6]. In addition, the most affected regions were America and Asia [7]. Several studies have highlighted the increasing global burden of leptospirosis, particularly in tropical and subtropical regions [8; 9]. Currently, leptospirosis is still under-reported, contributed by a wide range of non-specific clinical manifestations that mimic other endemic infectious diseases such as malaria and dengue [10-12].

In Malaysia, leptospirosis became a mandatory notifiable infectious disease in 2010. Since then, reported cases have increased exponentially, from 248 in 2004 to 3604 in 2012 [13]. Kelantan, in northeastern Malaysia, consistently reports the highest incidence rates, with 126.7 per 100,000 population in 2015 [14]. This might be due to their high annual rainfall, Kelantan being geographically prone to flooding and unstructured development harboured by the state [15; 16].

Cattle farmers have been identified as a high-risk group for leptospirosis in Malaysia due to their occupational exposure to contaminated environments [17]. This elevated risk has been supported by local studies demonstrating increased infection rates among cattle farmers [18]. Furthermore, this occupational group contributed to a high incidence of leptospirosis in Kelantan in 2016 [19], and Daud et al. (2018) reported a high seroprevalence of leptospirosis (72.5%) among cattle farmers in the state. However, despite these alarming findings, research on leptospirosis among cattle farmers in Malaysia remains limited.

Understanding the knowledge, attitudes, and practices (KAP) regarding leptospirosis among high-risk populations is crucial for disease prevention [20]. Knowledge and attitude can predetermine their practice on preventive measures against communicable diseases such as leptospirosis thus, improving their safety and health at work. Awareness and knowledge of the disease will create a basis for behavioural changes, which help in disease control by planning and prioritising resources to prevent the disease from occurring [21].

Several studies have emphasized the importance of KAP assessments in developing effective leptospirosis prevention strategies [22; 23]. For instance, despite the presence of adequate KAP within the study community in Sri Langka, gaps were identified from the understanding of the source and mode of transmission, symptoms, complications, risk factors, utilization of personal protective equipment, and prophylaxis, which could influence the extent and frequency of appropriate preventive measures [24]. While a study done in Elassona, Greece reported that education was positively correlated with enhanced knowledge and practices, whereas tight veterinarian oversight of the farm was linked to improved practices in zoonotic prevention such as leptospirosis [25].

Various knowledge, attitude, and practice studies on leptospirosis were done in Malaysia, but none were conducted among cattle farmers despite their being prone to leptospirosis infection. Therefore, this study aims to assess the level of knowledge, attitudes, and practices, along with associated factors, among seropositive leptospirosis cattle farmers in Kelantan.

2. METHODOLOGY

A cross-sectional study of 87 seropositive cattle farmers was carried out in northeastern Malaysia. This study was a continuation of a recent study by Daud et al., 2018 entitled “Study on Seroprevalence of Leptospirosis and Its Serovars Among Cattle Farmers in Northeastern Malaysia”, where the study revealed

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high seroprevalence of leptospirosis (73%) among cattle farmers in Northeastern Malaysia [26]. Seropositive farmers were defined as asymptomatic individuals whose microscopic agglutination test (MAT) showed fewer than 50.0% free Leptospira organisms in the control well. A titre threshold of ≥1:100 was used to classify farmers as seropositive, indicating prior exposure to Leptospira. Out of the 87 seropositive farmers, 73 were selected based on eligibility criteria, including a minimum of six months of occupational experience, ownership of at least three cattle, and use of either traditional or modern Travis systems for blood collection from cattle.

This study used a validated questionnaire by Azfar et al. [11] as the tool. Respondents participated in an interviewer-guided survey covering sociodemographic factors, as well as their knowledge, attitudes, and practices (KAP). The questionnaire demonstrated strong internal consistency, with Cronbach alpha values of 0.96 for knowledge, 0.71 for attitudes, and 0.74 for practices. The survey, delivered in Bahasa Malaysia—the native language of the participants, who were all Malays—took approximately 15 minutes to complete. To ensure consistency, only one interviewer conducted all the sessions, providing clarifications when necessary. The survey comprised two sections: the first focused on demographics, working conditions, and living environments, while the second addressed the participants' understanding, attitudes, and behaviors regarding leptospirosis.

The knowledge domain started by asking the respondents if they had ever heard about leptospirosis and the source of information that they had on leptospirosis. Only those who had heard of the disease proceeded to answer the rest of the knowledge questions. They were designed to be answered as “correct”, “incorrect” or “do not know”. For scoring, “2” marks were given for a correct response, “1” mark for “do not know”, and “0” mark for an “incorrect” response. Twenty-four knowledge questions covered the causes, signs, symptoms, complications, treatment, prevention, and risk factors of leptospirosis.

For the attitude domain, 12 questions covering safe work practices, personal protective equipment (PPE) and general practices were asked. Questions on attitude were designed to be answered using a Likert scale of “strongly agree”, “agree”, “not sure”, “disagree”, and “strongly disagree”. For positive attitude items, scores of “4”, “3”, “2”, “1”, and “0” for “strongly agree”, “agree”, “not sure”, “not agree”, and “strongly not agree” were given respectively. Meanwhile, the above scoring system was reversed for negative attitude items.

The questions on practice domain were also designed to be answered using a Likert scale of “never”, “seldom”, “sometimes”, “often” and “always”. For good practice items, scores of “4”, “3”, “2”, “1”, and “0” for “always”, “often”, “sometimes”, “seldom”, and “never” were given, respectively. The above scoring system was reversed for unsatisfactory practice items. A total of 12 questions on practices were asked, covering safe work practices and the use of PPE during work and off-work general practices.

Descriptive statistics for continuous variables were presented as means (SD), while categorical variables were shown as frequencies and percentages. The average scores (SD) for KAP items were also calculated. Knowledge, attitude, and practice responses were categorized based on percentages. For knowledge, a score of 72.0% or higher was considered good, while lower scores indicated poor knowledge [11]. Similarly, attitude and practice scores of 75.0% or higher were classified as satisfactory, while scores below this threshold were considered unsatisfactory.

The data were analysed using IBM SPSS version 24.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were described using means (SD). Univariable analysis through simple logistic regression was used to explore associations between KAP and variables such as sociodemographic characteristics, working conditions, and living environments. Variables with a p-value below 0.25 were further tested with multiple logistic regression. The preliminary final model was built using Forward Likelihood Ratio (Forward LR) selection and Backward Likelihood Ratio (Backward LR) elimination. No significant two-way interactions were detected, and multicollinearity was ruled out by Variance Inflation Factors (VIF) under 10. The model’s fitness was evaluated using the Hosmer-Lemeshow test, classification tables, and the area under the Receiver Operating Characteristic (ROC) curve. Variables with p-value <0.05 were considered as statistically significance in determing the predictors of in multiple logistic regression test.

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This was an anonymous survey, and participants' identities were not disclosed to management. The questionnaire was administered at the participants' convenience, and informed consent was obtained prior to the study. The research team had no conflicts of interest. Data entry into IBM SPSS was handled anonymously, with access restricted to research team members only. Data was presented in aggregate form to maintain confidentiality.

3. RESULTS

Seventy-three seropositive cattle farmers participated in this study, resulting in a response rate of 84%. All participants were of Malay ethnicity, with ages ranging from 22 to 81 years, and a mean (SD) age of 52.9 (14.33) years. Among them, 17.8% were female. The majority (82.2%) were married, with a mean (SD) of 4.6 (3.1) children. Only 5.5% of the respondents had no formal education. The average monthly income was RM1286, with 14 farmers (19.2%) earning RM2000 or more. Most of the farmers (57.5%) were non-smokers, and all had heard of leptospirosis, either through mass media or healthcare professionals. The sociodemographic details are summarized in Table 1.

Table 1 Sociodemographic characteristic*s* of seropositive cattle farmers (n=73)

Characteristics	n (%)	Mean (SD)
Age		52.9 (14.33)
Gender		
Male	60 (82.2)	
Female	13 (17.8)	
Marital Status		
Single	10 (13.7)	
Married	60 (82.2)	
Divorce	3 (4.1)	
Number of Children		4.6 (3.14)
Education Level		
No Formal Education	4 (5.5)	
Primary Education	17 (23.3)	
Secondary Education	39 (53.4)	
Tertiary Education	13 (17.8)	
Income		1286.03 (1084.24)
< RM1000	27 (37.0)	
RM1000 - RM1999	32 (43.8)	
≥ RM2000	14 (19.2)	
Smoking Status		
Smoker	31 (42.5)	
Non-smoker	42 (57.5)	
Heard about Leptospirosis		
Yes	73 (100.0)	
No	0 (0.0)	

Source: Aziah Daud et al (2026)

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Tables 2 and 3 provide details on the knowledge, attitude, and practice characteristics of the participants. Knowledge scores ranged from 44.0% to 94.0%, with a mean (SD) of 73.6 (10.68). In this study, 64.4% of respondents were found to have good knowledge of leptospirosis. On the other hand, attitude scores ranged from 33.0% to 100.0%, with a mean (SD) of 69.3 (15.82), and the majority of respondents (61.8%) displayed an unsatisfactory attitude towards leptospirosis. Moreover, 83.6% of the respondents were found to have unsatisfactory practices in preventing leptospirosis.

Table 2 Descriptive statistic of knowledge, attitude and practice score among seropositive cattle farmers (n=73)

Domain	Min (%)	Max (%)	Mean (SD)
Knowledge Score	44	94	73.6 (10.68)
Attitude Score	33	100	69.3 (15.82)
Practice Score	23	98	58.1 (16.40)

Source: Aziah Daud et al (2026)

Table 3 Proportion of knowledge, attitude and practice among seropositive cattle farmers (n=73)

Categories	n	(%)
Knowledge		
Good	47	(64.4)
Poor	26	(35.6)
Attitude		
Satisfactory	28	(38.4)
Unsatisfactory	45	(61.6)
Practice		
Satisfactory	12	(16.4)
Unsatisfactory	61	(83.6)

Source: Aziah Daud et al (2026)

3.1 Factors associated with Knowledge

Multiple logistic regression analysis identified three key factors associated with good knowledge among the seropositive cattle farmers: eating or drinking at the workplace, wearing rubber boots, and rat infestation at the workplace, as outlined in Table 4.

Table 4 Multiple logistic regression of factors associated with knowledge among seropositive cattle farmers (n=73)

Variables	β	Adjusted OR (95% CI)	Wald Statistic (df)	p-value
Eat/Drink at Workplace				
Yes		1		
No	1.69	5.40 (1.44,20.27)	6.25	0.012

Wear Rubber Boot				
No		1		
Yes	1.81	6.09 (1.34, 27.65)	5.47	0.019
Rat at Workplace				
No		1		
Yes	-1.62	5.03 (1.26, 20.12)	5.22	0.022

Multiple Logistic Regression
Constant = -1.202
Forward LR and backward LR method were applied.
No multicollinearity and no interaction between the variables.
Hosmer-Lemeshow test, p=0.907
Classification table was 72.6% correctly classified
Area under Receiver Operating Characteristics (ROC) curve was 73.2%

Source: Aziah Daud et al (2026)

Farmers who refrained from eating or drinking at their workplace were 5.4 times more likely to have good knowledge (95% CI: 1.44, 20.27; P = 0.012) compared to those who ate or drank at the workplace, after adjusting for the variables of wearing rubber boots and rat infestations. Additionally, those who wore rubber boots had 6.09 times the likelihood of possessing good knowledge (95% CI: 1.34, 27.65; P = 0.019) compared to those who did not wear rubber boots, when controlling for eating or drinking and rat sightings at the workplace. Furthermore, the presence of a rat infestation increased the odds of having good knowledge by 5.03 times (95% CI: 0.05, 0.80; P = 0.02) compared to workplaces without infestations, adjusting for eating or drinking and wearing rubber boots.

3.2 Factors associated with Attitude

In terms of attitude, the study found that cattle farmers who refrained from eating or drinking while working were 4.58 times more likely to have a satisfactory attitude (95% CI: 1.48, 14.17; P = 0.008) compared to those who ate or drank while working, after adjusting for the distance between their residence and the nearest river. Additionally, farmers who lived more than 200 meters from a river had 4.72 times the likelihood of having a satisfactory attitude (95% CI: 1.03, 21.68; P = 0.046) compared to those living less than 100 meters away, when the variable of eating or drinking was adjusted (Table 5).

Table 5 Multiple logistic regression of factors associated with attitude among seropositive cattle farmers (n=73)

Variables	β	Adjusted OR (95% CI)		Wald Statistic (df)	p-value
Eat/Drink					
Yes			1		
No	1.52	4.58	(1.48,14.17)	6.99	0.008
Distance From River					
< 100M			1		
100M-200M	0.52	1.68	(3.56,7.98)	0.43	0.512
> 200M	1.55	4.72	(1.03,21.68)	3.99	0.046

Multiple Logistic Regression
Constant = -2.942
Forward LR and backward LR method were applied.
No multicollinearity and no interaction between the variables.
Hosmer-Lemeshow test, p=0.995
Classification table was 71.2% correctly classified
Area under Receiver Operating Characteristics (ROC) curve was 80.5%
Source: Aziah Daud et al (2026)

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3.3 Factors associated with Practice

The study revealed that cattle farmers who did not eat or drink at their workplace were 11.76 times more likely to exhibit satisfactory practices (95% CI: 1.65, 83.70; P = 0.014) compared to those who did, after controlling for age and the use of rubber gloves. Furthermore, those who wore rubber gloves while working had 14.05 times the odds of demonstrating satisfactory practices (95% CI: 2.43, 81.37; P = 0.003) compared to those who did not, after adjusting for age and eating or drinking at the workplace. Additionally, each one-year increase in age was associated with 1.09 times higher odds of engaging in satisfactory practices (95% CI: 1.01, 1.17; P = 0.025), controlling for eating or drinking at the workplace and wearing rubber gloves (Table 6).

Table 6 Multiple logistic regression of factors associated with practice among seropositive cattle farmers (n=73)

Variables	β	Adjusted OR (95% CI)	Wald Statistic (df)	p-value
Age	1.50	1.09 (1.01,1.17)	5.01 (1)	0.025
Eat/Drink				
Yes		1		
No	1.27	11.76 (1.65,83.70)	6.06 (1)	0.014
Rubber Glove				
Yes		1		
No	2.06	14.05(2.43,81.37)	8.70 (1)	0.003

Multiple Logistic Regression
Constant = -4.82
Forward LR and backward LR method were applied.
No multicollinearity and no interaction between the variables.
Hosmer-Lemeshow test, p=0.212
Classification table was 89.0% correctly classified
Area under Receiver Operating Characteristics (ROC) curve was 85%
Source: Aziah Daud et al (2026)

4. DISCUSSION

Public health practice has since adopted KAP studies in various fields to understand the knowledge, attitude and practice of the respondents regarding certain subject matters. Gathering information on knowledge, attitude and practice can assist public health professionals and other related agencies to come up with practical preventive recommendations that can be implemented at ground level.

In this current study, most of the respondents (64.4%) have good knowledge of leptospirosis. This result was contrary to many KAP studies done among high-risk and non-high-risk groups in Malaysia. For example, Azfar et al. [11] discovered a low level of knowledge regarding leptospirosis among town service workers in Northeastern Malaysia and Sakinah et al. [27] elicited that only 2% of the respondents had good knowledge of leptospirosis in a non-high-risk group in Selangor, Malaysia. However, the same finding was found in a study by Edre et al. [28], where the majority of respondents from a flood-prone area in the central region of Malaysia had good knowledge on leptospirosis. This implies that the coverage of information regarding leptospirosis in the Malaysian population still needs to be well distributed despite continuous efforts done by the Malaysian government through the Ministry of Health (MOH) to educate the Malaysian population, especially those in high-risk groups. MOH is actively spreading awareness among the public, particularly in high-risk groups, regarding leptospirosis through various means, such as healthy education and promotion via mass media and health personnel [16]. A possible reason why cattle farmers have better outcomes in terms of knowledge is due to active engagement from other stakeholders, such as the veterinary department.

In Malaysia, the veterinary department is actively involved with leptospirosis prevention and control programs, including environment and animal sampling during an outbreak [29]. Engaging with various stakeholders is one of the key factors for intended information to reach specific targeted groups. This is in tandem with the One Health approach proposed by WHO, where all agencies such as veterinarians, clinicians, environmental health professionals, local authorities and universities work together to empower the community to fight against zoonotic diseases, particularly leptospirosis [30]. The One Health approach has gained increasing recognition in recent years for its effectiveness in addressing zoonotic diseases like leptospirosis [31; 32].

In addition, Nozmi et al. [33] reported that Malays had 2.6 times higher odds of having good leptospirosis knowledge than non-Malays. This is consistent with our findings, as all respondents were Malays, which may explain the high proportion demonstrating good knowledge regarding leptospirosis. Additionally, another possible reason could be due to a high prevalence of leptospirosis among Malays compared to other races in Malaysia [34], causing an increment in knowledge-seeking behaviour among them as a coping mechanism where Schneider et al. [35] suggested that the public's sensitivity on the disease will increase with the presence of a health warning.

In contrast to the knowledge scores, most cattle farmers exhibited poor attitudes and practices, with 61.8% and 83.6% scoring unsatisfactorily, respectively. This could be attributed to their limited perception of the benefits associated with leptospirosis prevention measures. Similar findings were revealed in a study by Edre et al. [28] among residents in a flood-prone area in Pahang, Malaysia, where a majority of the respondents had good knowledge but, at the same time, had unsatisfactory attitudes and practices. The low level of satisfactory attitude and practice was reflected by the increasing trend of leptospirosis in Kelantan, as described by Azimullah et al. [19]. These findings were in line with the Theory of Reasoned Action (TRA) proposed by Fishbein in 1967, where knowledge did not directly influence behaviour and practice. He suggested that attitude is the main factor that directly affects an individual's practice [36].

This study also found that cattle farmers who refrained from eating or drinking at their workplace were 5.4 times more likely to possess good knowledge, 4.58 times more likely to exhibit a positive attitude, and 11.76 times more likely to practice preventive measures compared to those who did consume food or beverages at work. It is known that eating or drinking at the workplace attracts rodents, particularly rats, especially when there are spillovers or leftover foods. Subsequently, workplaces with plenty of leftover food will become their breeding grounds [37]. Additionally, this finding may reflect a successful health education done by MOH towards cattle farmers where workers were encouraged to not eat or drink at their workplace as it is a risk factor for leptospirosis [11; 38].

This study also elicited that cattle farmers who wore rubber boots while working were 6 times more likely to have better knowledge regarding leptospirosis prevention compared to those who did not wear rubber boots while working. We also discovered that a majority of the respondents (83.6%) wore rubber boots while working. This finding was in contrast with a study by Nozmi et al. [33], where only 26.4% of the respondents wore rubber boots every time they worked, which equally reflected their low knowledge score. Rubber boots are among the personal protective equipment (PPE) that cattle farmers should wear to reduce the risk of leptospirosis infection, unlike rubber gloves and aprons [39]. However, the rubber boots need to be used appropriately, including washing after everyday usage. Without proper utilization, contaminated urine can still be in contact with the human body, hence increasing the chances of getting leptospirosis. This finding is reflected in a study that reported a high seroprevalence of leptospirosis among cattle farmers in Northeastern Malaysia despite having good knowledge of leptospirosis among a majority of them. Workers must be trained on proper PPE usage, such as donning and doffing, to maximize their protective properties [40].

Additionally, the presence of rats in the workplace was strongly linked to higher levels of leptospirosis knowledge. Farmers who experienced rat infestations were five times more likely to have good knowledge than those without this issue. Having rat infestation at their workplace made them more vigilant about the disease carried by the rodents. Moreover, as the rat is a well-known reservoir for leptospirosis [41], they might seek more knowledge regarding leptospirosis as leptospirosis is also commonly known as 'rat urine

disease' among the Malaysian population [42]. As they perceive rats as a threat, their knowledge-seeking behaviour regarding ways to eliminate the threat will increase. This was explained by Berdi et al. [43], who found that patients with low perceived threat levels have low knowledge of the disease. Recent research has explored innovative approaches to rodent control in leptospirosis prevention [44].

The study also revealed that cattle farmers residing more than 200 meters from a paddy field were 4.72 times more likely to have a positive attitude (95% CI: 1.03, 21.68; P= 0.046) compared to those living less than 100 meters away, after adjusting for eating or drinking at work and wearing long-sleeved shirts. Many studies proved that river-related activities were closely related to leptospirosis infection [45-47]. The river is also a breeding place for leptospirosis reservoirs, particularly rats [48]. Usually, a person who lives far away from a river will be less exposed to river-related activities and possibly less flood occurrence. This will reduce the time of contact with a leptospirosis-contaminated environment, as river and flood are environmental risk factors for leptospirosis [49; 50]. Baharom et al., [51] explored the role of environmental factors in leptospirosis transmission, such as water-related issues, infrastructure, landscape, and agriculture. However, the possible explanation for this irregularity is that access to health education and community initiatives plays a crucial role in shaping attitudes towards leptospirosis prevention. Farmers living farther from paddy fields may benefit from better access to educational resources that promote awareness of leptospirosis and its prevention. Studies have shown that individuals with higher levels of education regarding health risks are more likely to engage in preventive practices [20; 52]. Future qualitative study might be suitable to explain this phenomenon.

Moreover, the findings indicated that with each additional year of age, cattle farmers were 1.09 times more likely to adopt satisfactory practices (95% CI: 1.01,1.17; P= 0.025), adjusting for eating or drinking and wearing rubber gloves. The mean (SD) age of respondents was 52.9 (14.3) years, and the results align with other studies, such as by Brown et al. [53], which identified younger age as a risk factor for leptospirosis infection. This suggests that older farmers may have accumulated more experience and awareness of preventive measures against leptospirosis. In 2014, leptospirosis was more prevalent among younger individuals in Kelantan, with a mean age of 33.2 years [19], indicating that older farmers might be more vigilant about leptospirosis prevention.

Rubber gloves are a key component of personal protective equipment (PPE) in preventing leptospirosis [39]. This study found that cattle farmers who used rubber gloves had 14.05 times the odds of practicing good preventive behavior (95% CI: 2.43,81.37; P= 0.003) compared to those who did not, adjusting for age and eating habits at work. However, despite this association, the study reported a low percentage (19.2%) of farmers who wore gloves while working, reflecting an overall unsatisfactory practice level (83.6%). The same finding was found in a study by Azfar et al. [11], where a low percentage of respondents (43.0%) who wore rubber gloves while working was reported. Not wearing rubber gloves was reflected in the study with a reported high seroprevalence of leptospirosis (72.5%) among cattle farmers in the Kelantan from study by Daud et al., 2018, because almost all (90.0%) of them have direct contact with cattle via touching and a staggering percentage of them (75.3%) were still working despite having wound at either of their hands or feet [26]. Interestingly, some cattle farmers mentioned during interviews that they believed allowing cattle to lick their sweat helped establish a strong bond with the animals. This traditional belief, particularly common in Kelantan, extends to allowing cattle to lick their faces, further compounding the risk of leptospirosis infection.

This study has several notable strengths and limitations. Among its strengths is the high response rate (84%), which enhances the reliability and generalizability of the findings within the population of seropositive cattle farmers in northeastern Malaysia. The use of a validated questionnaire with strong internal consistency ensured the reliability of the KAP assessment. However, the study is limited by its cross-sectional design, which restricts causal inferences regarding the relationships between variables. The reliance on self-reported data may also introduce reporting bias, particularly in responses concerning practices. Additionally, the study focused exclusively on Malay farmers, limiting its applicability to more diverse populations. Finally, the absence of qualitative methods to explore underlying beliefs and practices

could have limited the depth of understanding of the cultural factors influencing leptospirosis prevention behaviors.

Future research should include qualitative studies to help uncover cultural beliefs, traditional practices, and challenges in adopting preventive measures like using protective gear. Expanding studies to include different ethnic groups and occupations would improve the applicability of the findings. Community-based health education programs should address gaps in attitudes and practices, using culturally sensitive approaches and involving key stakeholders like veterinary and public health agencies. Efforts should also focus on making protective gear more accessible and ensuring proper training for its use. Lastly, promoting the One Health approach can strengthen collaboration between sectors to address environmental, occupational, and behavioral factors in leptospirosis prevention.

5. CONCLUSION

This study provides a promising foundation for leptospirosis prevention among cattle farmers, as it reveals good knowledge levels about the disease. Future health promotion strategies should prioritize educating farmers about preventive measures and risk factors, aiming to improve attitudes and practices. The findings of this study can serve as a basis for targeted interventional studies among cattle farmers in Kelantan, addressing the alarmingly high prevalence in this high-risk group. Specifically, interventions should focus on enhancing attitudes and practices related to preventive measures, as the study identified these areas as particularly lacking despite good knowledge levels.

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7. CONFLICT OF INTEREST STATEMENT

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

8. AUTHORS' CONTRIBUTIONS

A.D. conceptualised the study, supervised the research, administered the project, secured funding, and approved the final manuscript. I.S.M.B. conducted data visualisation, and manuscript review and editing. E.A. contributed to study conceptualisation, validation, data collection, data curation, and manuscript review. W.M.Z.W.M. was involved in validation, formal analysis, supervision, and manuscript review and editing. N.I. conducted investigation activities, visualisation, and manuscript review and editing. F.A. contributed to conceptualisation, methodology development, validation, data curation, and manuscript review and editing. All authors have read and approved the final version of the manuscript.

9. ETHICS STATEMENT

The study was approved by the Jawatankuasa Etika Penyelidikan Manusia University Sains Malaysia (JePEM), Code: USM/JEPeM/18100512.

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About the Authors

Author 1
Aziah Daud is a faculty member in the Department of Community Medicine at Universiti Sains Malaysia. She obtained her Medical Doctor degree from Universiti Kebangsaan Malaysia and a Master of Public Health (Occupational Health) from Universiti Sains Malaysia. Her research focuses on leptospirosis, particularly among occupational high-risk groups, and has contributed to understanding the disease burden in Malaysia. She collaborates extensively with national and international agencies, including public health authorities and research networks. She can be contacted at aziahkb@usm.my.

Author 2
Ijlal Syamim Mohd Basri is a doctoral student in Public Health at Universiti Sains Malaysia and holds a Master of Public Health from the same institution. His academic training has provided a strong foundation in public health research methods, occupational health, and epidemiology. His research interests focus on infectious diseases and occupational health risks among high-risk populations. He can be contacted at ijlalsyamim@gmail.com.

Author 3
Elyas Ahmad is a public health medicine practitioner currently serving as the District Health Officer of Marang. He holds a Master of Public Health and a Doctor of Public Health degree from Universiti Sains Malaysia. His professional work focuses on public health administration, disease prevention and control, and community health programmes at the district level. His experience includes translating public health research into policy-relevant and operational strategies. He can be contacted at dr.elyas@moh.gov.my.

Author 4
Wan Mohd Zahiruddin Wan Mohammad is an associate professor in Department of Community Medicine at Universiti Sains Malaysia. His research interests include epidemiology and public health aspects of communicable diseases such as HIV/AIDS, tuberculosis, leptospirosis, and other infectious diseases. He has extensive experience in epidemiological analysis and public health research. He can be contacted at drzahir@usm.my.

Author 5
Nabilah Ismail is a clinical microbiologist at Hospital Pakar Universiti Sains Malaysia and is involved in diagnostic services, teaching, and research in medical microbiology. Her research primarily focuses on infectious diseases. She combines laboratory-based research with clinical applications to improve disease diagnosis and management. She can be contacted at drnabilah@usm.my.

Author 6
Fairuz Amran is a clinical microbiologist at the Institute for Medical Research with expertise in leptospirosis, mycology, and infections in immunocompromised patients. She holds medical and clinical microbiology qualifications and has received specialized training in leptospirosis. Her work includes laboratory diagnostics, outbreak investigations, and development of diagnostic tools, contributing significantly to infectious disease research in Malaysia. She can be contacted at fairuz.amran@gmail.com.

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