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Research Article

Knowledge, attitude, and preventive practices regarding the risk of Leptospirosis from rodents: A public health concern in District Kasur, Punjab, Pakistan

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Abstract

Leptospirosis is a zoonotic disease, and it finds its main reservoirs in the Norway rat (*R. norvegicus*) and black rat (*R. rattus*). The purpose of this study was to ascertain the level of knowledge, attitudes, and preventive practices of Kasur residents regarding the risk of leptospirosis from rodents. The current study was carried out in Kasur, Punjab. A total of 384 closed-ended questionnaires, each containing 34 questions, were distributed to randomly selected individuals from various backgrounds, such as students, teachers, health professionals, and housewives. In the statistical analysis, descriptive statistics and chi-square tests were performed using SPSS software. Among the respondents, more male respondents (n=199; 51.8%). The majority of respondents (n=222, 57.8%) reported that rodents are reservoirs of leptospirosis, and respondents from tehsils ($p=0.016$; $\chi^2=15.597$) were positively related to it. A large number of respondents (n=189; 49.2%) agreed that the presence of rodents is a big problem for humans, and respondents from tehsils were significantly correlated ($p=0.032$; $\chi^2=13.820$) with such people's attitudes. Most of the respondents n=212; 55.2%) protected themselves from leptospirosis by wearing protective gears, and the relationship among people of four tehsils ($p=0.018$; $\chi^2=15.266$) with the frequency of using

different PPE was statistically significant. The results of this study showed that respondents had good knowledge, attitudes, and preventive practices related to the risk of leptospirosis from rodents. Community education is an important aspect of improving the management of rodents and their disease.

Keywords: Rodents, leptospirosis, zoonotic diseases

Introduction

Various significant environmental changes, such as the expanding human population, shifts in climate patterns, and the destruction of wildlife habitats by humans, represent key factors contributing to the emergence and progression of zoonotic diseases. Consequently, the number of reported zoonotic cases has exceeded one billion, with a steady annual increase noted (Farid et al., 2021). Among the agents involved in the maintenance and transmission of these diseases, rodents play a pivotal role (Tomassone et al., 2018). Rodents belong to the order Rodentia and are characterized by rapid sexual maturation, short gestation periods, variable sizes, opportunistic behaviors, and distinctive gnawing teeth (Khan et al., 2022; Witmer, 2022). They belong to the order Rodentia, comprising more than 2,000 species spanning 30 families (Farid et al., 2021). This highly diversified group accounts for more than 42% of the world's mammalian biodiversity (Propper et al., 2024). In Pakistan, there are a total of 43 rodent species, with rats and mice being the predominant types (Khan et al., 2022). The three most prevalent rodent species closely associated with humans are the black rat (*Rattus rattus*), brown rat (*Rattus norvegicus*) and house mouse (*Mus musculus*) (Guo et al., 2017).

Leptospirosis is a bacterial and zoonotic disease that primarily affects humans and primarily affects the main reservoirs in Norway rats (*R. norvegicus*) and black rats (*R. rattus*), which contaminate the environment with excreta (Boey et al., 2019). Leptospirosis is a zoonotic and bacterial infection caused by a gram-negative bacterial species called Spirochetes (Haake & Levett, 2015; Pathman et al., 2018). These spirochetes are known as *Leptospira interrogans* (Abdullah et al., 2019; Shafie et al., 2021). This disease mostly occurs in tropical or subtropical areas due to favourable conditions for the transmission of spirochete bacteria (Haake & Levett, 2015). It can cause many diseases, such as renal failure, hepatic failure, pulmonary hemorrhage, and even death (Pui et al., 2017). Humans are infected with *Leptospira* by direct contact with the urine, blood, or tissues of infected animals and infected by indirect contact with pathogen-contaminated soil and water during professional and recreational activities (Prabhu et al., 2014; Murray, 2015).

Overall, the mortality rate in humans varies from 1 to 5%, and elderly individuals are considered to be at high risk of leptospirosis (Pui et al., 2017). The occurrence rates are often undervalued because of the relative inaccessibility, absence of rapid diagnostic techniques, lack of awareness about leptospirosis (Krijger et al., 2019), and the cause of febrile illness symptoms (De Vries et al., 2014). Leptospirosis accounts for 20% to 40% of idiopathic febrile illness cases. These symptoms can be quite diverse and often resemble other diseases, such as malaria, viral hepatitis, yellow fever, dengue, bacterial and viral meningitis (Cosson et al., 2014).

Knowledge, attitude, and preventive practice studies on risk of leptospirosis from rodents have been conducted in different countries, such as KAP studies on leptospirosis in Jamaica (Brown et al., 2011), Brazil (de Araujo et al., 2013), India (Prabhu et al., 2014), the Philippines (Arbiol et al., 2016), Northeastern Malaysia (Pathman et al., 2018), and Argentina (Ricardo et al., 2018), but there are no published data on this in Pakistan. Consequently, the current research aims to fill this gap by focusing on understanding the knowledge, attitudes, and preventive practices of the local population concerning the leptospirosis risks from rodents that can concern for public health. This study aimed to evaluate the level of individual knowledge, attitudes, and preventive practices related to leptospirosis risk from rodents and also identified the risk factors associated with the understanding of knowledge, attitudes and preventive practices that may provide valuable insights into public awareness and behaviour, and how such knowledge can be crucial for effective disease prevention and management strategies that individuals take. In four tehsils of Kasur district.

Material and methods

Study area

This Cross-sectional study was conducted in the four tehsils (Kasur, Chunian, Kot Radha Kishan, and Pattoki) of Kasur district. The Kasur district is located in the heart of Punjab province, Pakistan. Previously, it was part of the Lahore district, but now it is a separate district that has coordinates of approximately 31° 05' north and 74° 31' east, and spans an area of approximately 3995 square kilometers. (Arshad & Imran, 2017; Andleeb et al., 2018; Ali et al., 2021).

Study Design

A cross-sectional study was conducted in the Kasur district, and the sample size of participants was determined using the sample size formula (Thrusfield, 2018).

$$n= (Z\alpha)^2 P (1-P)/d^2$$

Where n is the estimated sample size, Zα is the standard normal deviation commonly denoted as 1.96 associated with a 95% confidence interval, P is the previous prevalence and d is the desired absolute precision of 5% or 0.05. The number of respondents from the study area was calculated by considering the 52% community awareness prevalence of leptospirosis (Mohan & Chadee, 2011).

$$n= (1.96)^2\ 0.52\ (1-0.52)/0.05^2=384$$

We collected 384 respondents from the district of Kasur. To ensure the representativeness of the sample, the overall population of the district was stratified. A stratified random sampling technique was applied, where the district population was stratified by tehsils and individuals were randomly selected within each stratum (Pathman et al., 2018). This approach helps to ensure that the sample is reflective of the broader population and allows for meaningful insights to be drawn from the study.

Ethical approval

This study was approved by the Institutional Review Committee for Biomedical Research (No. 167/IRC/BMR, Dated: 30/5/2022), University of Veterinary and Animal Sciences, Lahore, Pakistan. Before administering the questionnaire, ethical considerations were taken in the informed consent form for the participants.

Data collection

This study was carried out between September 2022 and December 2023. A total of 384 closed-ended questionnaires were distributed, and 34 questions were included in the questionnaire. These questions were not only easy but also easily understood by participants. The data were collected via face-to-face interviews with randomly selected participants. Those participants included those who were willing to participate in this study and were above the age of eighteen (Essayah *et al.,* 2019). The information collected from participants will be kept anonymous and used only for scientific purposes (Nava-Doctor et al., 2021). The information was collected from participants with diverse occupational backgrounds to enhance the generalizability of findings related to knowledge, attitudes, and practices concerning leptospirosis.

Statistical analysis

The statistical analysis was conducted using SPSS version 21, developed by IBM in Armonk, New York, USA. Descriptive statistics, including frequency and proportion, were used to summarize the categorical variables. The chi-square test was employed to assess the significant association between the respondents in the Tehsils and their knowledge, attitudes and preventive practices

about the risk of leptospirosis from rodents (P≤0.05) (Saeed et al., 20i9; Saeed et al., 2020; Li et al., 2021).

Results

Sociodemographic Information

The 384 questionnaires distributed among the people of the Kasur district were distributed as follows: Kasur (n=125; 32.6%), Chunian (n=100; 26.0%), Kot Radha Kishan (n=69; 18.0%) and Pattoki (n=90; 23.4%). Overall, there were more male respondents (n=199; 51.8%), but at the tehsil level, more male respondents n=68; 17.7% belong to Kasur tehsil. Regarding age, most respondents were young (n=158; 41.1%) in all but at the tehsil level, most of the respondents, n=50 (13.0%) from Kasur tehsil, were adults (Table 1).

Table 1. Sociodemographic data of participants.

Variables	**Categories**	**Tehsils**				**Total n (%)**
		Kasur n (%)	**Chunian n (%)**	**Kot Radha Kishan n (%)**	**Pattoki n (%)**	
Gender	Female	57(14.8)	49(12.8)	33(8.6)	46(12.0)	185(48.2)
	Male	68(17.7)	51(13.3)	36(9.4)	44(11.5)	199(51.8)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**
Age	Youth (18-34)	46(12.0)	45(11.7)	29(7.6)	38(9.9)	158(41.1)
	Adult (35-64)	50(13.0)	36(9.4)	27(7.0)	35(9.1)	148(38.5)
	Elderly (>65)	29(7.6)	19(4.9)	13(3.4)	17(4.4)	78(20.3)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**
Urbanicity	Rural	55(14.3)	48(12.5)	32(8.3)	40(10.4)	180(46.9)
	Urban	70(18.2)	52(13.5)	37(9.6)	50(13.0)	204(53.1)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**
Marital status	Single	71(18.5)	59(15.3)	39(10.2)	47(12.2)	216(56.2)
	Married	54(14.1)	41(10.7)	30(7.8)	43(11.2)	168(43.8)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**
Religion	Muslim	72(18.8)	57(14.8)	36(9.4)	45(11.7)	210(54.7)
	Christian	23(6.0)	20(5.2)	14(3.6)	21(5.5)	78(20.3)
	Hindu	16(4.2)	13(3.4)	12(3.1)	15(3.9)	56(14.6)
	Sikh	14(3.6)	10(2.6)	7(1.8)	9(2.3)	40(10.4)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**

Education	Primary (1-5 years of schooling)	25(6.5)	20(5.2)	17(4.4)	23(6.0)	87(22.7)
	Secondary (6-10 years), higher secondary education (11-12 years)	38(9.9)	26(6.8)	22(5.7)	28(7.3)	111(28.9)
	High education (Bachelor's and postgraduate degree)	62(16.1)	54(14.1)	30(7.8)	39(10.2)	186(48.4)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**
Occupations	Students	26(6.8)	20(5.2)	12(3.1)	16(4.2)	75(19.5)
	Teachers	19(4.9)	17(4.4)	11(2.9)	18(4.7)	65(16.9)
	Health professionals	33(8.6)	28(7.3)	16(4.2)	22(5.7)	98(25.5)
	Housewife	18(4.7)	16(4.2)	9(2.3)	14(3.6)	60(15.6)
	Others	29(7.6)	19 (4.9)	21(5.5)	20(5.2)	86(22.4)
Total number of respondents		**125(32.6)**	**100(26.0)**	**69(18.0)**	**90(23.4)**	**384(100)**

Knowledge about the risk of leptospirosis from rodents

The respondents responded to leptospirosis risks from rodents. Our study showed the majority of respondents (n=222, 5.7.8%) reported that rodents are reservoirs of leptospirosis and tehsils ($p=0.016$; $\chi^2=15.597$) were positively related to it. About n=201; (52.3%) of the respondents claimed that they knew about leptospirosis, and the tehsils were significantly correlated with the frequency of knowledge about leptospirosis ($p=0.000$; $\chi^2=26.638$). The majority of respondents (n=191; 49.7%) knew that leptospirosis is a zoonotic disease, and the tehsils ($p=0.528$; $\chi^2=5.126$) did not influence the frequency of it being a zoonotic disease (Table 2).

Table 2. Knowledge of participants about the risk of leptospirosis from rodents.

Variables	**Categories**	**Tehsils**				**Total n (%)**	**P-value (χ^2 value)**
		Kasur **n (%)**	Chunian **n (%)**	Kot Radha Kishan **n (%)**	Pattoki **n (%)**		

Do rodents are reservoir of leptospirosis?	Yes	88(22.9)	49(12.8)	41(10.7)	44(11.5)	222(57.8)	**0.016** (15.597)
	No	23(6.0)	35(9.1)	18(4.7)	27(7.3)	103(26.8)	
	Don't know	14(3.6)	16(4.2)	10(2.6)	19(4.9)	59(15.4)	
Do you know about leptospirosis?	Yes	80(20.8)	56(14.6)	36(9.4)	29(7.6)	201(52.3)	**0.000** (26.638)
	No	26(6.8)	34(8.9)	21(5.5)	45(11.7)	126(32.8)	
	Don't know	19(4.9)	10(2.6)	12(3.1)	16(4.2)	57(14.8)	
Do you know leptospirosis is a zoonotic disease?	Yes	59(15.4)	48(12.5)	41(10.7)	43(11.2)	191(49.7)	0.528 (5.126)
	No	35(9.1)	33(8.6)	16(4.2)	24(6.3)	108(28.1)	
	Don't know	31(8.1)	19(4.9)	12(3.1)	23(6.0)	85(22.1)	
What is the causative agent of leptospirosis?	Bacteria	77(20.2)	58(15.1)	38(9.9)	51(13.3)	224(58.3)	0.323 (6.980)
	Virus	36(9.4)	27(7.0)	17(4.4)	20(5.2)	100(26.0)	
	Don't know	12(3.1)	15(3.9)	14(3.6)	19(4.9)	60(15.6)	
What is the main cause of leptospirosis?	Contact with rodent	84(21.9)	51(13.3)	36(9.4)	31(8.1)	202(52.6)	**0.000** (27.734)
	Flood water	25(6.5)	40(10.4)	26(6.8)	41(10.7)	132(34.4)	
	Don't know	16(4.2)	9(2.3)	7(1.8)	18(4.7)	50(13.0)	
What is the transmission route of leptospirosis?	Cuts or wounds on body parts	73(19.0)	46(12.0)	26(6.8)	35(9.1)	180(46.9)	**0.025** (14.452)
	Contaminated food and	30(7.8)	36(9.4)	31(8.1)	40(10.4)	137(35.7)	

	water by rodents						
	Don't know	22(5.7)	18(4.7)	12(3.1)	15(3.9)	67(17.4)	
What are the signs and symptoms of leptospirosis?	Muscle pain	23(6.0)	17(4.4)	13(3.4)	15(3.9)	68(17.7)	0.652 (9.589)
	Yellow eyes or skin	35(9.1)	29(7.6)	18(4.7)	22(5.7)	104(27.1)	
	Kidney and liver damage	22(5.7)	20(5.2)	21(5.5)	25(6.5)	88(23.0)	
	Death	30(7.8)	18(4.7)	9(2.3)	19(4.9)	76(19.8)	
	Don't know	15(3.9)	16(4.2)	8(2.1)	9(2.3)	48(13.0)	
Do you know someone who is bitten by rodents?	Yes	30(7.8)	25(6.5)	11(2.9)	15(3.9)	81(21.1)	0.545 (4.994)
	No	60(15.6)	42(10.9)	32(8.3)	44(11.5)	178(46.4)	
	Don't know	35(9.1)	33(8.6)	26(6.8)	31(8.1)	125(32.6)	
If yes, do you know someone who gets leptospirosis by biting rodents?	Yes	9(2.3)	7(1.8)	8(2.1)	10(2.6)	34(8.9)	**0.001** (24.088)
	No	70(18.2)	54(14.1)	55(14.3)	59(15.4)	238(62.0)	
	Don't know	46(12.0)	39(10.2)	6(1.6)	21(5.5)	112(29.2)	
What is the source of information about leptospirosis?	Media	51(13.3)	41(10.7)	31(8.1)	39(10.2)	162(42.2)	
	Health center or clinic	30(7.8)	25(6.5)	15(3.9)	19(4.9)	89(23.2)	0.999 (1.055)
	Community associations	26(6.8)	20(5.2)	13(3.4)	17(4.4)	76(19.8)	
	Books	18(4.7)	14(3.6)	10(2.6)	15(3.9)	57(14.8)	

Attitudes about the risk of leptospirosis from rodents

This study further assessed participants' attitudes towards leptospirosis risk from rodents. Our study determined that A large number of respondents (n=189; 49.2%) agreed that the presence of rodents is a big problem for humans, and tehsils were positively correlated (p=0.032; χ^2=13.820) with people's attitudes that they face problems due to rodents. Most of the respondents (n=218; 56.8%) agreed that rodent population control is the best way to avoid leptospirosis, and there was a significant correlation among the tehsils and the frequency of prevention of leptospirosis (p=0.020; χ^2=15.059). The majority of people n=176; 45.8%) agreed that they get leptospirosis when they expose themself to outdoor activities and occupations, but interestingly, thehsils (p=0.976; χ^2 =1.216) have no statistically significant association with this fact (Table 3).

Table 3. Attitudes of participants about the risk of leptospirosis from rodents.

Variables	Categories	Tehsils				Total n (%)	P-value (χ^2 value)
		Kasur n (%)	Chunian n (%)	Kot Radha Kishan n (%)	Pattoki n (%)		
The presence of rodents is a big problem for humans.	Agreed	61(15.9)	49(12.8)	33(8.6)	46(12.0)	189(49.2)	**0.032** (13.820)
	Disagreed	31(8.1)	35(9.1)	28(7.3)	34(8.9)	128(33.3)	
	Don't know	33(8.6)	16(4.2)	8(2.1)	10(2.6)	67(17.4)	
Controlling the rodent population is the best way to avoid leptospirosis.	Agreed	86(22.4)	54(14.1)	34(8.9)	44(11.5)	218(56.8)	**0.020** (15.059)
	Disagreed	25(6.5)	34(8.9)	20(5.2)	33(8.6)	112(29.2)	
	Don't know	14(3.6)	12(3.1)	15(3.9)	13(3.4)	54(14.1)	
You get leptospirosis when you expose yourself to outdoor activities and occupations.	Agreed	60(15.6)	46(12.0)	30(7.8)	40(10.4)	176(45.8)	0.976 (1.216)
	Disagreed	34(8.9)	32(8.3)	23(6.0)	29(7.6)	118(30.7)	

	Don't know	31(8.1)	22(5.7)	16(4.2)	21(5.5)	90(23.4)	
Treatments at the initial stage are a good decision to avoid leptospirosis.	Agreed	55(14.3)	51(13.3)	35(9.1)	43(11.2)	184(47.9)	0.726 (3.636)
	Disagreed	31(8.1)	26(6.8)	18(4.7)	27(7.0)	102(26.6)	
	Don't know	39(10.2)	23(6.0)	16(4.2)	20(5.2)	98(25.5)	
Leptospirosis can cause the death of humans if it remains untreated.	Agreed	62(16.1)	49(12.8)	39(10.2)	46(12.0)	196(51.0)	0.883 (2.363)
	Disagreed	36(9.4)	32(8.3)	16(4.2)	23(6.0)	107(27.9)	
	Don't know	26(6.8)	18(4.7)	14(3.6)	21(5.5)	81(21.1)	
Leptospirosis is a curable disease.	Agreed	53(13.8)	45(11.7)	29(7.6)	35(9.1)	162(42.2)	0.963 (1.439)
	Disagreed	38(9.9)	32(8.3)	24(6.3)	30(7.8)	124(32.3)	
	Don't know	34(8.9)	23(6.0)	16(4.2)	25(6.5)	98(25.5)	
Herbal medicine can be used to treat leptospirosis.	Agreed	49(12.8)	46(12.0)	31(8.1)	44(11.5)	170(44.3)	**0.048** (12.677)
	Disagreed	36(9.4)	34(8.9)	24(6.3)	35(9.1)	139(33.6)	
	Don't know	40(10.4)	20(5.2)	14(3.6)	11(2.9)	85(22.1)	
Vaccines are more harmful than good for this disease.	Agreed	25(6.5)	31(8.1)	16(4.2)	20(5.2)	92(24.0)	**0.000** (25.965)
	Disagreed	53(13.8)	39(10.2)	42(10.9)	57(14.8)	191(49.7)	
	Don't know	47(12.2)	30(7.8)	11(2.9)	13(3.4)	101(26.3)	

Preventive practices for the risk of leptospirosis from rodents

Respondents must be aware of different actions as necessary to control leptospirosis and rodents in their community, so respondents were asked questions about the preventive practices of risk of leptospirosis from rodents. Most of the respondents n=212; 55.2%) protected themselves from leptospirosis by wearing protective gears, e.g., masks, gloves and boots and the relationship among people of four tehsils ($p=0.018$; $\chi^2=15.266$) with the frequency of using different PPE was statistically significant. Whereas (n=195; 50.8%) knew that through the rat trap, they could protect their houses from rodents but interestingly, tehsils ($p=0.971$; $\chi^2=1.317$) have no statistically significant correlation with these strategies to control the rodents. The majority of people (n=225; 66.4%) killed the rodents when they saw them, and tehsils were significantly correlated with the frequency of reactions of people after seeing rodents ($p=0.000$; $\chi^2=26.096$) (Table 4).

Table 4. Preventive practices of participants for the risk of leptospirosis from rodents.

Variables	Categories	Tehsils				Total n (%)	P-value (χ^2 value)
		Kasur n (%)	Chunian n (%)	Kot Radha Kishan n (%)	Pattoki n (%)		
How can you protect yourself from leptospirosis by using which PPE?	Masks, gloves and boots	59(15.4)	70(18.2)	38(9.9)	45(11.7)	212(55.2)	**0.018** (15.266)
	Washing Hands with antiseptic soaps	34(8.9)	16(4.2)	18(4.7)	29(7.6)	97(25.3)	
	Enter sewage with proper protection	32(8.3)	14(3.6)	13(3.4)	16(4.2)	75(19.5)	
How can you protect your	Using rat traps	64(16.7)	50(13.0)	34(8.9)	47(12.2)	195(50.8)	0.971 (1.317)

houses from rodents?	Using rat poison	33(8.6)	30(7.8)	17(4.4)	24(6.3)	104(27.1)	
	Through cat	28(7.3)	20(5.2)	18(4.7)	19(4.9)	85(22.1)	
What to do when you see rodents?	Go away from rodents	29(7.6)	18(4.7)	12(3.1)	17(4.4)	76(19.8)	**0.000** (26.092)
	Kill them	65(16.9)	78(20.3)	49(12.8)	63(16.4)	255(66.4)	
	Ignore them	31(8.1)	4(1.0)	8(2.0)	10(2.6)	53(13.8)	
How do you dispose of dead rodents?	In plastic bag	33(8.6)	17(4.4)	15(3.9)	16(4.2)	81(21.1)	**0.024** (14.564)
	Buried in mud	38(9.9)	27(7.0)	13(3.4)	14(3.6)	92(24.0)	
	Throw them in the open place	54(14.1)	56(14.6)	41(10.7)	60(15.6)	211(54.9)	
Which precautions do you follow to avoid getting leptospirosis?	Maintaining cleanliness	52(13.5)	34(8.9)	24(6.3)	26(6.8)	136(35.4)	0.596 (4.597)
	Don't touch the rodents	58(15.1)	49(12.8)	36(9.4)	50(13.0)	193(50.3)	
	Don't walk in floodwater	15(3.9)	17(4.4)	9(2.3)	14(3.6)	55(14.3)	
How can you recover when you get the leptospirosis?	Go to doctor	43(11.2)	32(8.3)	22(5.7)	27(7.0)	124(32.3)	0.997 (0.573)
	Take antibiotics	65(16.9)	55(14.3)	38(9.9)	51(13.3)	209(54.4)	
	Get vaccine	17(4.4)	13(3.4)	9(2.3)	12(3.1)	51(13.3)	
Do you go to the doctor if you have fever for more than two days?	Yes	40(10.4)	30(7.8)	23(6.0)	34(8.9)	127(33.1)	**0.044** (12.967)
	No	36(9.4)	13(3.4)	19(4.9)	20(5.2)	88(22.9)	
	Ignore	49(12.8)	57(14.8)	27(7.0)	36(9.4)	169(44.0)	

Do you follow health guidelines during the rainy season?	Yes	24(6.3)	27(7.0)	22(5.7)	36(9.4)	109(28.4)	**0.033** (13.706)
	No	30(7.8)	20(5.2)	9(2.3)	13(3.4)	72(18.8)	
	Ignore	71(18.5)	53(13.8)	38(9.9)	41(10.7)	203(52.9)	

Discussion

This study is the first KAP study on leptospirosis that has been performed according to the currently available literature**.** In our study, it is worth noting that the majority of the respondents were male and had various backgrounds, including study, teaching, and health professionals, such as human and animal health-related roles. Awareness among professionals about zoonotic diseases can significantly affect the development of effective prevention and control strategies for this disease. People from different professions were chosen to measure their perceptions of different diseases (Islam & Ahmed, 2019). This diversity in the sample population can provide valuable insights into the knowledge and attitudes of individuals from different backgrounds. Rodents often harbour a range of parasites responsible for causing various diseases. These diseases collectively affect approximately 400 million people worldwide each year (Vanden Broecke et al., 2021; Propper et al., 2024). These disparities highlight the importance of public education and awareness campaigns regarding the health risks associated with rodents and the diseases they cause.

In our study, 52.3% (n=201) of respondents were aware of leptospirosis**,** which is a zoonotic disease (n=191; 49.7%). A study by Allwood et al. (2014) in Jamaica, where 97% of people knew about leptospirosis. In Malaysia, 52% and 13% of people in Tobago and Trinidad, respectively, heard about leptospirosis (Mohan & Chadee, 2011; Sulong et al., 2011). A study by Brown et al. (2011) was performed in Jamaica, where 82.7% of people knew leptospirosis is a zoonotic disease. Our study revealed that the majority of respondents (n=202; 52.6%) knew that contact with rodent excreta is the main cause of leptospirosis. It has been stated that infected rodents excrete pathogens through urine that transmit the disease to humans (Jahan et al., 2021). Most of the people (46.9%) in our study answered that cuts and wounds on body parts are the main routes of leptospirosis transmission, but in a previous study in Malaysia (36.8%), the respondents were aware of this fact. It is important to evaluate the knowledge of respondents about the disease because if they know about the transmission of the disease, they will be able to take preventive actions against contracting it (Samsudin et al. 2020).

In our study, the respondents knew about the different signs and symptoms of leptospirosis. If respondents have good knowledge about the signs and symptoms of leptospirosis, it will be helpful in diagnosing leptospirosis at an early stage, which could result in valid case management or proper treatment to reduce mortality (Sharma & Yadav, 2008). Our study also revealed that a substantial number of respondents knew someone who had been bitten by rodents. Previous findings have been reported in Malawi, where 90% of respondents mentioned that rodents can bite people. Approximately 49% of respondents in the previous study reported having been bitten by a rat (Donga et al., 2022; Eisen et al*.,* 2013). Interestingly, in our study, the respondents had limited knowledge about individuals contracting leptospirosis after being bitten by rodents. This finding parallels a previous study in which a significant percentage of people (91.2%) did not know about this phenomenon (Mohan & Chadee, 2011). This suggests a potential need for increased education and awareness about the health risks associated with rodent bites and the importance of preventive measures.

In this study, most of the respondents (n=189; 49.2%) agreed that the presence of rodents is a major problem for humans. Due to their frequent interactions with humans, rodents pose a heightened risk to public health. The primary modes of pathogen transmission from rodents to humans and livestock involve direct contact with rodent excreta and indirect contact with ectoparasites (Rabiee et al., 2018). A similar study was conducted in southern Malaysia, where most of the respondents knew that the increased risk of leptospirosis is due to rodent waste (Ridzuan et al., 2016).

Participants reported using various rodent control strategies to prevent their entry into homes, using poisons, traps, and cats. Most of the respondents (50.8%) in this study used rat traps to protect their houses from rodents. A study was performed in Brazil (24.1%), Malawi (45%), and Uganda (58%) people used traps (de Araujo et al., 2013; Donga et al., 2022; Eisen *et al.,* 2013). Most of the respondents (66.4%) in our study killed rodents when they saw them. The control of leptospirosis in rodents is very important because these animals are considered the basic source of leptospirosis in humans (Mohan & Chadee, 2011).

We observed that participants used different methods for disposing of dead rodents as waste, but the majority threw them in open places, where they often became food for predators. Many of these rodents had died due to rodenticides or as a result of different types of diseases, including leptospirosis. Consequently, some predators such as dogs and cats are domestic animals, consume contaminated carcasses, and are subsequently affected by either toxin or infectious agents. These

infected pets may serve as potential vectors for transmitting diseases to humans, including pet owners, veterinarians, and other animals. In our study, most respondents reported taking antibiotics to recover from leptospirosis. Most individuals who experienced fever for more than two days ignored it and did not visit the doctor, possibly due to the general population's limited awareness of leptospirosis, which is often referred to as a silent killer due to its ability to cause asymptomatic or mild, flu-like symptoms. It may go unnoticed until the condition becomes severe and potentially untreatable (Haake & Levett, 2015).

Conclusion

The study highlighted the different factors involved in knowledge and practices related to leptospirosis and rodent prevention that can be a big threat to human health. Knowledge about the risk of leptospirosis from rodents can be improved in the community because community participation is the main aspect of public health, and the risk of the disease can be decreased by the involvement of the local community. These findings will serve as a baseline for future disease surveillance and control programs and provide initial-level data that will help improve and develop policies about public health and better treatment plans, including vaccines. Moreover, this information might be useful for promoting proper hygiene management to prevent leptospirosis.

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