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Assessment of the Knowledge and Awareness of Leptospirosis among Households, Farmers, and Livestock Keepers in Unguja Island, Tanzania: A Cross-Sectional Study

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Abstract: Limited understanding exists concerning leptospirosis in Zanzibar. The objective of this study is to evaluate the degree of knowledge and awareness of leptospirosis within the urban and peri-urban populations of Unguja. A cross-sectional study was conducted utilizing semi-structured questionnaires from January to April 2022. Two hundred respondents were randomly selected (130 males and 70 females) aged between 18 and 89 years. Descriptive analysis was employed to assess the main trends in knowledge and awareness, and $\chi 2$ analysis was utilized to determine associations between demographic characteristics with respondents' knowledge and awareness. The majority of respondents (64%) lacked awareness of leptospirosis' etiology, but a significant proportion of respondents had a favorable attitude (68.6%) towards leptospirosis compared to their average knowledge and awareness (35%) and practices (29.3%). Nonetheless, the livestock keeper, farmers, fishermen, and healthcare providers had low levels of knowledge and awareness. The findings also demonstrated that males had a strong association with occupational physical activities, while educational level was associated with preventive practices. Living in urban or peri-urban areas was significantly linked with the respondents' practices. The study's outcomes demonstrated low levels of community knowledge and awareness regarding leptospirosis' etiology, mode of transmission, and symptoms among livestock keepers, farmers, fishermen, and healthcare providers. Although most respondents had a favorable attitude, their low level of knowledge and poor practices indicate that supplementing a positive attitude with enhanced knowledge and awareness is necessary to promote individual engagement in preventive measures.

Keywords: Leptospirosis; Awareness; Knowledge, Zoonosis; Health Risk; Prevention

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1. Introduction

Leptospirosis is a bacterial zoonotic disease caused the spirochete bacteria of the genus *Leptospira*. The disease has been identified as a global public health problem in animals and humans in different areas in the world [1]. Globally, yearly death cases of about 58,900 are reported., It is estimated that between 300 000 and 500 000 severe cases occur with a mortality rate of up to 30% [2]. Moreover, [3] has reported an incidence of 100 cases per 100 000 people suffering from leptospirosis. According to [1], acute human leptospirosis has been recorded in 18 African nations. The level of knowledge and awareness of the disease is low among the general public and health care providers [4]. The signs and symptoms of the disease vary with the host and in animals include jaundice, hemoglobinuria, renal damage with a high mortality in lambs and kids and milk drop syndrome. Also, *Leptospira* localized in the uterus and oviducts may result in stillbirths, abortions, neonatal and infertility [5]. In humans, the illness is characterized by high fever, headache, jaundice, chills, vomiting, muscle pains and red eyes [6]

In Tanzania, leptospirosis is a neglected public health problem, and both animals and humans are at high risk of contracting the disease.The bacterium is transmitted by rodents, shrews, and other small mammals to humans and animals through contact with water, soil and food contaminated with urine of infected rodents, meat and other bodily fluids or via broken skin or mucous membrane or bite from infected animals [4]. About 70% of Tanzanians are engaged in farming activities, livestock keeping and fishing activities thus at high risk of getting leptospirosis [4]. Moreover, other people such as miners, butchers, dairy workers, sewer workers, veterinarians, people who happen to drink untreated contaminated river water as well as people who eat rodents are at high risk of contracting the disease [1]. Tanzania has 33.9 million cattle, 24.5 million goats and 8.5 million sheep, 3.2 million pigs and 87.7 million chickens [7]. Zanzibar has 270 998 cattle, 111 623 goats, 934 sheep, 2209 pigs and 3.8 million chickens [7] and 8095 dogs [8]. In recent years, Sub-Saharan African countries, including Tanzania mainland have experienced periodic outbreaks of human and animal leptospirosis in many regions, the most recent being human leptospirosis in Ruangwa, Lindi [9]. Other regions such as Morogoro have recorded a prevalence of (10.8%–13%) [10] in humans. Kilimanjaro experienced a prevalence of (9–20%) [11] and Katavi 29.96% [12]. Other researcher in Tanzania have documented leptospirosis in both wild and domestic animals [10,13,14]. Prevalences of 22.9% in rodents [15], 30.37% in cattle [12], 41% in pigs, 38% in goats and sheep 38% [10]. In a recent study, the overall seropositivity of leptospirosis in the urban and peri-urban has been reported to be 9.67% in rodents, 14.57% in cattle, 10.01% in goats, 31.25% in sheep and 26.25% in dogs [16]. However, in Zanzibar there was scarce information on community awareness or knowledge of causative agents, transmission, clinical signs and control, as well as inadequate diagnostic tools for leptospirosis, Thus, the disease is underreported or go unnoticed, there is only one study that has reported the prevalence of leptospirosis as being less than 1% in patients at Mnazi Mmoja Hospital in Zanzibar [17]. No study has reported on the level of knowledge, attitude, awareness, perceptions and control practices of animal leptospirosis in the Island. This study aimed to address that information gap regarding this disease.

2. Materials and Methods

2.1. Description of the study area

The study was conducted in Unguja, Zanzibar. Unguja (1666 km^2) and Pemba (988 km^2) are the two largest islands in Zanzibar. Bigger Unguja has population of 896 721 [18] with an annual population growth rate of 2.8%. The major economic activities in Zanzibar are agriculture, tourism and fishing, agriculture being the mainstay of Zanzibar's economy with a contribution to the national Gross Domestic Product (GDP) estimated at 26.9%

[7]. Six districts were selected in this study, then were further divided into urban (Magharibi A and Mjini) and peri-urban (Kati, kusini, kaskazini A and Kaskazini B)., The Sites were spread across the entire island to ensure territorial representation of the sample.

2.2. Study design and sampling strategy

This study employed a cross-sectional study design to investigate the research question of interest. Eligible participants for this study were consenting individuals between the ages of 18 and 89 years, who resided in the study area, while those who expressed their unwillingness to participate were excluded. The study area comprised six selected districts, namely Peri-urban (Kusini, Kaskazini A, Kaskazini B, and Kati), urban (Mjini), and Magharibi A. The total population size of this area was 689,816 individuals [18]. To determine an appropriate sample size for the study, Slovin's equation was used with a 95% confidence level [19], which yielded an estimated sample size of 200 respondents. This was calculated using the formula n=N/ (1 + Ne2), where n represents the estimated sample size, N denotes the population size, and e represents the acceptable error, which was set at 5% (0.05).

2.3. Data collection

The targeted population consisted of individuals employed in animal-related occupations, specifically farmers, livestock keepers, fishermen, and other similar professions. The data collection process involved the utilization of a semi-structured questionnaire to obtain information pertaining to the community's awareness, knowledge, attitudes, and practices concerning leptospirosis in domestic animals and rodents. Verbal interviews were conducted for illiterate respondents to ensure the acquisition of relevant data. Prior to administering the Swahili translated structured questionnaire, each participant was presented with a consent form (as included in the Appendix) to indicate their willingness to participate in the study. Demographic information, including age, sex, educational level, occupation, and location, was collected alongside data related to etiology, transmission, clinical signs, practices, and owner knowledge regarding animal and human leptospirosis. Household data collection encompassed ownership of livestock, agricultural features such as animal types and quantities present in the surrounding area, crop variety, the presence and diversity of rodents, frequency of rodent sightings inside the house, evidence of rodent damage to stored food, rodent consumption by individuals, seasonal variations in rodent diversity and abundance, and rodent control practices. Additionally, questions were posed concerning the physical characteristics of the compounds, including the building material of the house, the source of drinking/bathing/sanitation water, and the likelihood of flooding.

2.6. Data analysis

The present study utilized Microsoft Excel Window 2007 as a spreadsheet to store the data, which was subsequently analyzed through the application of the Statistical Package for Social Sciences (SPSS) version 25.0. The Chi-square test was employed as the analytical tool to determine the existence of statistically significant differences (p-value of ≤ 0.05) in relation to the respondents' knowledge and awareness of leptospirosis, with particular attention given to their demographic characteristics. Additionally, descriptive data analysis such as means, frequencies and proportions were also conducted to enhance the understanding of the research findings.

3. Results

3.1. Demographic characteristics of the respondents

The study involved interviewing a total of 200 participants, with 67.5% and 32.5% representing individuals hailing from peri-urban and urban regions, respectively. Among the 200 respondents, 65% (130) were identified as male, whereas 35% (70) were female.

The average age of the participants was established as 38.4 years, with a notable preponderance of respondents aged between 28 to 37 years (36%). With regards to educational attainment, the majority of respondents reported a secondary level education (61%), and the primary occupation of the participants was primarily identified as farming (35.5%), as evidenced in Table 1.

Table 1. Demographic characteristics of the study respondents.

Characteristics		Frequency	Percent
Sex	Male	130	65.0
	Female	70	35.0
Age	18-27	40	20.0
	28-37	72	36.0
	38-47	40	20.0
	48-57	28	14.0
	58_and_ above	20	10.0
Location	Peri-urban	135	67.5
	Urban	65	32.5
Occupation	Farmer	71	35.5
	Self-Employed	45	22.5
	Employed	35	17.5
	Student	11	5.5
	Livestock-keeper	23	11.5
	Fishermen	15	7.5
Education Level	Primary school	46	23.0
	Secondary school	122	61.0
	College or University	26	13.0
	Others	6	3.0

3.2. General knowledge regarding leptospirosis

Out of the of 200 participants, the survey results revealed that 64% of respondents (n=176) were unaware of the underlying causes of leptospirosis, while the remaining 36.0% (n=72) displayed a level of awareness regarding the etiological agents of the disease. The most frequently reported symptoms of leptospirosis among the participants were high fever (33.0%, n=66), headache (21.0%, n=42) and muscle aches (13.5%, n=27), as demonstrated in Table 2. Furthermore, a significant proportion of the respondents identified contact with water contaminated with urine or animal tissue (36.5%, n=73) and consumption of food tainted with urine or animal tissue (31.5%, n=63) as modes of transmission for the disease.

Table 2. General knowledge about leptospirosis disease (Homa ya Mgunda).

Characteristics		Frequency	Percent
Knowledge on etiology	viral-disease	44	22.0
	bacterial-disease	72	36.0
	protozoa-disease	56	28.0
	fungal-disease	26	13.0
	Genetic-disease	2	1.0
Knowledge on Transmission	contact with water contaminated with urine/animal tissue	73	36.5

	contact food contaminated with urine/animal tissue	63	31.5
	contact with soil contaminated with urine/animal tissue	31	15.5
	broken skin/mucous membrane	2	1.0
	bite from infected animal	31	15.5
Knowledge on symptoms of Leptospirosis	high fever	66	33.0
	Headache	42	21.0
	Chills	26	13.0
	muscle aches	27	13.5
	Vomiting	13	6.5
	Jaundice	26	13.0

3.3. Attitude and practices regarding leptospirosis

The findings revealed that a significant proportion of the respondents agreed with the need for treatment of drinking water at the household (65.0%, n=130), while the majority disagreed with the practice of eating rodents (83.5%, n=167). Furthermore, a majority of the participants agreed with the proposition that leptospirosis could be transmitted from animals to humans through the urine of infected animals (55%, n=110), and that rodents and other animals serve as carriers of the bacteria (64.5%, n=129). In addition, a high proportion of the respondents agreed that certain occupational groups, including farmers, sewer workers, slaughterhouse and veterinary workers, animal caretakers, fish workers, mine workers, and dairy farmers, are at high risk of exposure to the disease (75%, n=150). Notably, the study found that awareness of leptospirosis was statistically significant ($p \leq 0.05$) with respect to the respondents' attitudes.

Table 3. Attitude regarding leptospirosis.

Characteristics		Frequency	Percent	P-value
Drinking water at this household treated?	Strongly disagree	11	5.5	
	Disagree	19	9.5	
	Moderate	40	20.0	
	Agree	91	45.5	
	Strongly agree	39	19.5	
Do people eat rodents?	Strongly disagree	100	50.0	0.003
	Disagree	67	33.5	
	Moderate	6	3.0	
	Agree	14	7.0	
	Strongly agree	13	6.5	
Leptospirosis can be transmitted from animal to human through the urine of infected animal	Strongly disagree	1	0.5	0.004
	Disagree	3	1.5	
	Moderate	86	43.0	
	Agree	89	44.5	
	Strongly agree	21	10.5	
Rodents, domestic and wild animals are carriers of the bacteria	Disagree	2	1.0	
	Moderate	69	34.5	
	Agree	113	56.5	
	Strongly agree	16	8.0	
Farmers, sewer workers, slaughterhouse, veterinary and animal caretakers, fish workers, mine workers and dairy	Strongly disagree	2	1.0	
	Disagree	2	1.0	
	Moderate	46	23.0	
	Agree	126	63.0	

farmers are at risk of exposure to leptospirosis	strongly agree	24	12.0

Strongly agree and agree are compiled together as agree and strongly disagree and disagree are compiled as disagreed.

3.4. Awareness of leptospirosis according to the age group of respondents

Regarding the level of knowledge about leptospirosis among different age groups, results indicated that the age group ranging from 28 to 37 years exhibited a superior understanding of leptospirosis in comparison to the age groups spanning 38 to 47 years, 48 to 57 years, 58 years and above, and 18 to 27 years, respectively. However, it is noteworthy that the awareness of the disease across age groups did not demonstrate statistical significance ($p > 0.05$), possibly indicating an overall unfamiliarity with the disease. Additionally, the age groups below 58 years demonstrated a greater awareness of the causative agents, transmission, and clinical symptoms of leptospirosis in comparison to the age group above 58 years, as evidenced by Table 4.

Table 4. Awareness of leptospirosis according to the Age group of respondents.

Knowledge regarding leptospirosis		**correct answer (frequency and percentage)**						
		18-27, n=46	**28-37, n=66**	**38-47, n=40**	**48- 57, n=28**	**58 and above, n=20**	**Chi-square**	**P-Value**
Knowledge on etiology Leptospirosis disease is a?	bacterial-disease	13(28.3)	28(42.4)	14(35)	11(39.3)	6(30)	11.1	0.805
Knowledge on transmission How does a person get leptospirosis?	Contact with water contaminated with urine/animal tissue	20(43.5)	20(30.3)	15(37.5)	8(28.6)	10(50)	22.7	0.121
	Contact food contaminated with urine/animal tissue	10(21.7)	24(36.4)	17(42.5)	5(17.9)	7(35)		
	Contact with soil contaminated with urine/animal tissue	9(19.6)	12(18.2)	1(2.5)	8(28.6)	1(5)		
Knowledge on clinical symptoms, what are the symptoms of Leptospirosis?	High fever	9(19.6)	19(28.8)	18(45)	13(46.4)	7(35)	20.2	0.445
	Headache	13(28.3)	16(24.2)	7(17.5)	4(14.3)	2(10)		
	Muscle aches	6(13)	10(15.2)	4(10)	3(10.7)	4(20)		

3.5. Awareness of leptospirosis according to locations

It was found that a greater percentage of respondents residing in peri-urban areas (28%) had awareness of leptospirosis (Homa ya Mgunda) compared to those living in urban areas (24%). This disparity may be attributed to the high population of respondents in peri-urban areas and their exposure to risk factors associated with the disease. However, the knowledge pertaining to the transmission and causative agents of leptospirosis was not found to be statistically significant ($p > 0.05$). Interestingly, respondents from peri-urban areas exhibited a greater awareness of the clinical symptoms associated with

leptospirosis as compared to their urban counterparts. The difference in knowledge levels between these two locations was found to be statistically significant ($p < 0.05$), as depicted in Table 5.

Table 5. Awareness on leptospirosis according to locations.

Knowledge regarding to leptospirosis		Correct answer (frequency and percentage) Peri-urban area, n=135	Urban area, n=65	Chi-square	P-value
Knowledge on etiology Leptospirosis disease is a?	Bacterial-disease	53(39.3)	19(29.2)	3.173	0.529
Knowledge on transmission How does a person get leptospirosis?	Contact with water contaminated with urine/animal tissue	50(37)	23(35.4)		
	Contact food contaminated with urine/animal tissue	46(34)	17(26.2)	5.437	0.245
	Contact with soil contaminated with urine/animal tissue	21(15.6)	10(15.4)		
Knowledge on clinical symptoms, what are the symptoms of Leptospirosis?	High fever	56(41.5)	10(15.4)	14.713	0.012
	Headache	23(17)	19(29.2)		

3.6. Awareness of leptospirosis according to occupation status

Fishermen exhibited a relatively higher level of awareness (30.2%) regarding leptospirosis, followed by farmers (27.6%), self-employed individuals (26.4%), students (26%), livestock keepers (25%), and employed individuals (24.9%), respectively. The proportions of awareness were observed to be relatively similar across the different occupations, suggesting no statistically significant difference ($p > 0.05$) in the awareness levels of leptospirosis across the various occupational groups, as presented in Table 6.

Table 6. Awareness on leptospirosis according to occupation.

Knowledge regarding to Leptospirosis		correct answer (frequency and percentage) Farmer, n=71	Self-employed, n=45	Employed, n=35	Livestock keeper, n=20	Fishermen, n=18	Student, n=11	Chi-square	P-value
Knowledge on etiology Leptospirosis disease is a?	Bacterial-disease	24(33.8)	20(44.4)	12(34.3)	6(30)	8(44.4)	2(18.2)	28.804	0.092
Knowledge on transmission How does a person get leptospirosis?	Contact with water contaminated with urine/animal tissue	23(32.4)	19(42.2)	10(28.6)	6(30)	12(66.7)	3(27.3)		
	Contact food contaminated with urine/animal tissue	29(40.8)	12(26.7)	10(28.6)	5(25)	2(11.1)	5(45.5)	23.223	0.278
	Contact with soil contaminated with urine/animal tissue	10(14.1)	7(15.6)	7(20)	4(20)	2(11.1)	1(9.1)		
Knowledge on clinical symptoms, what are the	High fever	29(40.8)	9(20)	7(20)	6(30)	10(55.6)	5(45.5)	27.246	0.344
	Headache	13(18.3)	8(17.8)	10(28.6)	6(30)	2(11.1)	3(27.3)		
	Muscle aches	9(12.7)	8(17.8)	5(14.3)	2(10)	2(11.1)	1(9.1)		

symptoms of Leptospirosis ?						

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3.7 Awareness of leptospirosis according to educational level 220

The study outcomes indicate that respondents who attained college or university-level education demonstrated a relatively higher level of knowledge (42.3%) concerning leptospirosis as compared to their counterparts with lower educational levels: primary (26.7%) and secondary education (26.4%), respectively. The proportions of knowledge were observed to be relatively similar across the different educational levels, implying a lack of statistically significant difference ($p > 0.05$) in the awareness levels of leptospirosis across various educational groups, as presented in Table 7. These findings suggest a general low level of knowledge and awareness of leptospirosis across different educational levels. 221 222 223 224 225 226 227 228 229

Table 7. Awareness of leptospirosis according to educational level. 230

Knowledge regarding leptospirosis		Primary school, n=46	Secondary school, n=122	College or university, n=26	Chi-square	P-value
Knowledge on etiology Leptospirosis disease is a?	Bacterial-disease	12(26.1)	46(37.7)	11(42.3)	12.211	0.429
Knowledge on transmission How does a person get leptospirosis?	Contact with water contaminated with urine/animal tissue	19(41.3)	42(34.4)	10(38.5)	3.784	0.987
	Contact food contaminated with urine/animal tissue	14(30.4)	38(31.1)	8(30.8)		
	Contact with soil contaminated with urine/animal tissue	6(13)	21(17.2)	4(15.4)		
Knowledge on clinical symptoms, what are the symptoms of leptospirosis?	High fever	24(52.2)	33(27)	8(30.8)	15.186	0.438
	Headache	6(13)	27(22.1)	7(26.9)		
	Muscle aches	5(10.9)	19(15.6)	2(7.7)		

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3.8 Awareness of leptospirosis according to sex 232

The findings of this study indicate that the male participants (26.9%) exhibited a higher level of awareness towards leptospirosis in comparison to their female counterparts (26.3%). Furthermore, the former group demonstrated a statistically significant increase in their comprehension of the transmission of the disease ($p < 0.05$), as evidenced by Table 8 which presents the data on leptospirosis awareness categorized by gender. 233 234 235 236 237

Table 8. Awareness of leptospirosis according to gender. 238

Knowledge regarding to leptospirosis		correct answer (frequency and percentage)			
		Male, n=130	Female, n=70	Chi-square	P-value
Knowledge on etiology Leptospirosis disease is a?	Bacterial-disease	51(39.2)	21(30)	3.91	0.418
Knowledge on transmission How does a person get leptospirosis?	Contact with water contaminated with urine/animal tissue	36(27.7)	37(52.9)	15.782	0.003
	Contact food contaminated with urine/animal tissue	49(37.7)	14(20)		
	Contact with soil contaminated with urine/animal tissue	19(14.6)	12(17.1)		
Knowledge on clinical symptoms, what are the	High fever	45(34.6)	21(30)		
	Headache	28(21.5)	14(20)	1.075	0.956

symptoms of leptospirosis?	Muscle aches	17(13.1)	10(14.3)

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3.9 Awareness of practices regarding leptospirosis 240

The practice of intensive or zero-grazing was observed to be prevalent in Unguja island, with a significant proportion of respondents (51%) reporting the utilization of tethered grazing system. The majority of the animals (94.5%) were aged between 1 to 5 years, and cattle were predominantly kept within the compound (47%). Approximately three quarters of the animals (75%) were born in Zanzibar, except for sheep which were imported from the mainland, with a majority (86.5%) being locally bred. Respondents reported encountering rodents in their houses at varying frequencies, with most indicating sightings less than once a week (30.5%), more than once a week (28.5%), or on a daily basis (27.5%). A majority of the respondents utilized piped water (71.5%) as their primary water source, and the majority reported infrequent or no treatment (40%) of their drinking water. Metal sheets were commonly used as the roofing material, while floors and walls were typically constructed using cement (90.5%). Most of the respondents (96%) reported implementing some form of rodent control measures in their households, including the use of chemical rat poisons (39%) and biological controls (38.5%) such as dogs and cats. Respondents reported sightings of rodents in both the wet and dry seasons, with the majority (59.5%) reporting the presence of rodents throughout the year.

Table 9. General awareness of practices regarding to leptospirosis. 257

		Frequency	Percent
Type of animal kept	Cattle	94	47.0
	Goat	54	27.0
	Sheep	11	5.5
	Dogs	13	6.5
Breed	Local	173	86.5
	Improved	27	13.5
Sex	Male	102	51.0
	Female	98	49.0
Age	1-5 years	189	94.5
	6 years and above	11	5.5
Animal origin	Born in Zanzibar	150	75.0
	Imported from Mainland	50	25.0
Pregnant	Yes	43	21.5
	No	157	78.5
Stage of pregnancy	1st trimester	26	13.0
	2nd trimester	16	8.0
	3rd trimester	1	0.5
	None	157	78.5
Grazing system	Tethered	102	51.0
	Intensive	47	23.5
	Semi-intensive	50	25.0
Source of drinking water	Piped water into home	143	71.5
	Public/communal well	35	17.5
	Stream moving water directly	11	5.5
Drinking water treated	Always	63	31.5
	Often	57	28.5
	Infrequently	67	33.5
	Never	13	6.5
How is treated	Boiling	72	36.0
	Adding disinfectant	70	35.0
Flooding	Yes	23	11.5
	No	177	88.5
House roofing	Thatch	12	6.0
	Tiles	4	2.0
	Metal	181	90.5

Floor wall and material	Cement	181	90.5
	mud or manure	12	6.0
	wood stone	6	3.0
Crops grown	Paddy	16	8.0
	Cassava	10	5.0
	Maize	11	5.5
	Coconut	25	12.5
	Spice	7	3.5
	Banana	22	11.0
	Mango	10	5.0
	Sweet potato	9	4.5
	Others	55	27.5
Evidence of rodents	Everyday	55	27.5
	More than once a week	57	28.5
	Less than once a week	61	30.5
	Never	27	13.5
People eat rodents	Yes	31	15.5
	No	169	84.5
Rodents control	Yes	192	96.0
	No	8	4.0
Type of rodents control	Mechanical eg traps	42	21.0
	Chemical eg poisons	78	39.0
	Biological eg keeping predators	77	38.5
	Leave them where they die	8	4.0
Rodents carcasses	Throw them in the bush	75	37.5
	Burn	22	11.0
	Bury	38	19.0
	Feed to other animals	38	19.0
	Consume	13	6.5
Rodents seen different seasons	Many	119	59.5
	Few	65	32.5
	None	3	1.5
	Don't know	13	6.5

4. Discussion

This was the first study to be conducted in Unguja island that aimed at assessing the community knowledge and awareness regarding leptospirosis. Our findings show, a generally low knowledge and awareness of leptospirosis among livestock keepers, farmers, fishermen and health care providers, these findings are similar to what was previously reported by [10]. A large number of the study participants were not aware of leptospirosis, only few reported having heard or being aware of the etiology of the disease (36%). These results are comparable to those reported from a study carried out in Malaysia which found that only 43% were aware of leptospirosis [20]. Otherwise, our study showed that a small percentage of participants were knowledgeable of leptospirosis and got the information from district extension officer and para-veterinarians. This may probably be due to poor coverage of veterinary services, lack of health education and information concerning the disease, especially awareness through different media such as television, newspapers and radio station in the island [4]

Respondents mentioned as symptoms, high fever (33.0%), headache (21.0%) and muscle aches (13.5%), and many of them were not able to describe the symptoms of the disease. This situation may be explained by under-recognition of the disease in the island [21] and the resemblance of its symptoms with Malaria. Moreover, 36.5% of the respondents mentioned contact with water and with food (31.5%) contaminated with urine/animal tissue as being a risk factor for getting leptospirosis in the island. In urban area, most roads contained stagnant water filled with dirt water, increasing the risk of contracting the disease but many people were not aware.

The results show that the respondents had good attitude (68.6%) compared to knowledge and awareness (35%) in average as well as practices (29.3%). This may imply that having good attitude is not enough to prevent the disease or change peoples' behaviour. Therefore, satisfactory attitude should be complimented with awareness and knowledge, to ensure the individual practices intervened with control measure [22]. Education level had significant relation with preventive practices, implying that those with college or university education level would have better knowledge of leptospirosis control than those who were with primary education level (p=0.048). In fact, educated individual are capable to interpret and digest the risk factors associated with the disease compared to those with lower level of education [4]

A large number of participants reported seeing many rodents and their droppings inside and around their houses on a regular basis. Evidence of rodents near the house and peridomestic have been reported by [23] as the risk factor for human and animal *leptospira* exposure.

Moreover, some community members are unaware of leptospirosis, even though others, over the age of 27, were more knowledgeable about the etiology, symptoms and mode of transmission of disease than the respondents under the age of 27. Additionally, some of the para-veterinary professionals and health workers who were interviewed agreed that the community does not know about the disease, even the Swahili translation name called Homa ya Mgunda was not known. This result is similar to the one conducted in Eastern Tanzania [24] which found a quite similar low level of awareness of leptospirosis in the community.

Farmers, Livestock keeper and fishermen proved to be the occupational groups that is most at risk of contracting leptospirosis, with proportion of 35.5%, 11.5% and 7.5% respectively. This finding is consistent with the results of a study conducted in Tanga which found that farmers, meat inspector, livestock and abattoirs were most at risk of contracting the disease [25]

The results showed a significant association between gender versus practices and attitude. The majority of the respondents in both urban and peri-urban settings were male, they had good practices and attitude score compared to female. This situation may be explained by the fact that occupational activities included in the study (i.e fishing, livestock keeping, agricultural activities, sewers and abattoirs workers) are practiced mostly by males because they are outdoor ussually practiced by men. Furthermore, most of the women's time is spent indoor, thus reducing their risk of contracting disease compared to males [26]**.** This study echoes the study by [27], where the number of males with leptospirosis was high compared to that of females, reflecting occupational exposure in male dominated activities. However, this study was in contrast with the one conducted in Malaysia, which reported that female had good attitude than male because females were more concerned with daily hygiene than males [28,29]

In this study, 86.5% of the respondents mentioned rat sighting in the compounds, rodents dropping on top of shelves where food is stored, in barns where animal feeds or grains stored and peridomestic, therefore most of the people in the island (64.5%), had knowledge that rats play important role in disease transmission to humans but they did not know exactly what disease the rat carry. Most of the respondents were not familiar with the term ''Leptospirosis'' or" Homa ya Mgunda''. However, they were familiar with plague disease (Ugonjwa wa Tauni) due its publicity in different media. This finding is similar with that or other studies [30,31]

The rodent's species prevalence of 9.67% reported by [16] imply that rat carry the pathogen and passes it via their urine to humans and animals pose a huge risk of the disease. In the Island, majority of the respondents mentioned cattle (47%) and goats (27%) as animals kept in their compounds and they apply zero grazing and tethering systems. Animal indirect exposure through feed or pasture contaminated with urine of infected animal or drinking contaminated water. This agrees with the study by [32], who found an association between cattle contact and people.

Some respondents mentioned tethering method (51%) as the commonly grazing practice in Zanzibar, and 86.5% respondents indicated that indigenous cattle (zebu breeds) are kept by grazing practices. Most of these domestic animals were tethered close to crops such as sweet potatoes, cassava, grazing pasture and banana, probably due to shortage of land, in peri-urban areas. Many farmers preferred to move to intensive system, probably due to shortage of forage and legumes plants [33]. Therefore, there is no pure pastoral system in Zanzibar and food vendors and consumers are at high risk of contracting leptospirosis due to close contact with domestic animals and rodents within their compounds. All cats were more commonly found in the environment, especially in urban area, which poses the high risk of spreading the disease via their urine. Pets are kept in homes, including dogs and cats. Respondents (6.5%) mentioned dogs as companion animals and for security purposes and for hunting in peri-urban settings. Moreover, low percentage of respondents recognized pigs, pets and other animals (20.5%) as the source of leptospirosis. These domestic animals were raised closely to the human settlement, where the animal feed was not protected, risking being contaminated with the rodent's droppings and urine. In Tanzania mainland, people practice pastoral systems, where hundreds of domestic animals can be vaccinated at once. In contrast, animals in Zanzibar are scattered in small holdings around villages, where vaccinating, requires a huge effort to put together a big herd [34]**.** Subsequently, only a small percentage of the animal's population are vaccinated against leptospirosis [35]

Lastly, the growing population and urbanization in Unguja forces farmers and livestock keepers to shift to more intensive ways of farming, probably due to shortage of grazing rangeland, in order to maximize the productivity of their land. A bulk of the respondents (71.5%) mentioned piped water as their source of drinking water, which was not treated, hence posing a risk of leptospirosis. Considering that livestock rearing plays an important role in both household income and nutritional status in urban and peri-urban communities [36]**,** it is important to implement management practices such as rat control to prevent animals from getting into contact with contaminated water sources. Also, there is a dire need to avail treatment and vaccination to ensure animal productivity

5. Conclusions

Overal, our study provides valuable insights into the prevalent agricultural practices and housing conditions in Unguja island. Intensive or zero-grazing was observed to be a commonly adopted practice among the respondents, with the tethered grazing system being the most frequently utilized approach. The majority of the animals were relatively young, with cattle primarily kept within the compound. Additionally, we found that rodents were a frequent occurrence in households, with a majority of respondents implementing various control measures to manage their presence. The utilization of piped water was widespread among the respondents, with a significant proportion reporting infrequent or no treatment of their drinking water. These findings highlight the need for continued research and intervention efforts to improve animal health and hygiene, as well as housing and water quality standards in the region.

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Institutional Review Board Statement: This study adhered to the requisite research clearance and ethical protocols, which were duly sanctioned by Sokoine University of Agriculture (Ref. No. SUA/ADM/R.1/8/779 and Ref. No. DPRT/SUA/R/186/F.7), and further authorized by the Office of the Second Vice President of Zanzibar (Ref. No. OMPR/M.95/C.6/2/VOL.XVIII/187) to conduct the study within the geographic boundaries of Zanzibar. Prior to the commencement of data collection, a consent form was employed to solicit the voluntary participation of the respondents, in line with established ethical practices.

Informed Consent Statement: Not applicable.
Data Availability Statement: The original data generated by this study is available on reasonable request addressed to the corresponding author.

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