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Evaluation of community knowledge and awareness of Leptospirosis among households, farmers and livestock keepers in Unguja, Zanzibar

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Abstract

Little is known of the leptospirosis in Zanzibar. This study aims to assess the level of knowledge and awareness of leptospirosis among urban and peri-urban communities in 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 performed to determine the main trends of the knowledge and awareness, while $\chi 2$ analysis was conducted to identify associations between demographic characteristics with respondents' knowledge and awareness. The majority of the respondents (64%) were not aware of the etiology of leptospirosis.However, a high percentage of respondents had a favorable attitude (68.6%) towards leptospirosis compared to knowledge and awareness (35%) and practices (29.3%). However, there was low level of knowledge and awareness among the livestock keeper, farmers, fishermenand health care providers. 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 appeared strongly associated with practice of the respondents. The results of this study showed a low level of community knowledge and awareness regarding the etiology, mode of transmission and signs of leptospirosis among livestock keeper, farmers, fishermen and health care 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: *attitude; awareness; knowledge; leptospirosis; practices; Unguja; zoonosis*

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Introduction

Leptospirosis is a zoonotic bacterial disease' caused by 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 (Allan *et al*., 2015). Worldwide, 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% (Costa *et al*., 2015). Moreover, WHO (2011) has reported an incidence of 100 cases per 100 000 people suffering from leptospirosis. According to Allan *et al*., (2015), 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 (Mgode *et al*., 2017). 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 (Ellis, 2015). Also, *Leptospira* localized in the uterus and oviducts may result in stillbirths, abortions, neonatal and infertility (Ellis, 2015). In humans, the illness is characterized by high fever, headache, jaundice, chills, vomiting, muscle pains and red eyes (WHO, 2003).

In Tanzania, leptospirosis is a neglected public health problem and both animals and humans areat 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 (Mgode *et al*., 2017). About 70% of Tanzanians are engaged in farming activities, livestock keeping and fishing activities thus at high risk of getting leptospirosis (Mgode *et al*., 2017). Moreover, occupational exposures such as miners, butchers, dairy workers,sewer workers, veterinarians and people who happen to drink untreated contaminated river water and individuals who eat rodents are at high risk of contracting the disease (Allan *et al.,* 2015).

Tanzania has 33.9 million cattle, 24.5 million goats and 8.5 million sheep, 3.2 million pigs and 87.7 million chickens (URT, 2021). Zanzibar has 270 998 cattle, 111 623 goats, 934 sheep, 2209 pigs and 3.8 million chickens (URT, 2021) and 8095 dogs (Zanzibar Livestock Survey, 2020). Inrecent 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 (Tanzania Ministry of health, 2022). Other regions such as Morogoro have recorded a prevalence of (10.8%–13%) (Mgode *et al*., 2015) in humans. Kilimanjaro experienced a prevalence of (9–20%) (Biggs *et al*., 2011) and Katavi 29.96% (Assenga *et al*., 2015). Other researchers' in Tanzania have documented leptospirosis in both wild and domestic animals (Machang'u *et al*., 1997; Kessy *et al*., 2005; Mgode *et al*., 2015). Prevalence of 22.9% in rodents (Katakweba *et al*., 2018), 30.37% in cattle (Assenga *et al*., 2015), 41% in pigs,38% in goats and sheep 38% (Mgode *et al*., 2015). In a recent study, the overall seropositivity of leptospirosis in the urban and peri-urban has been reported to be 7.7% % in humans (Ally *et al*., 2023). 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 goes 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 (Ali *et al*., 2020). 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.

Materials and Methods

Description of the study area

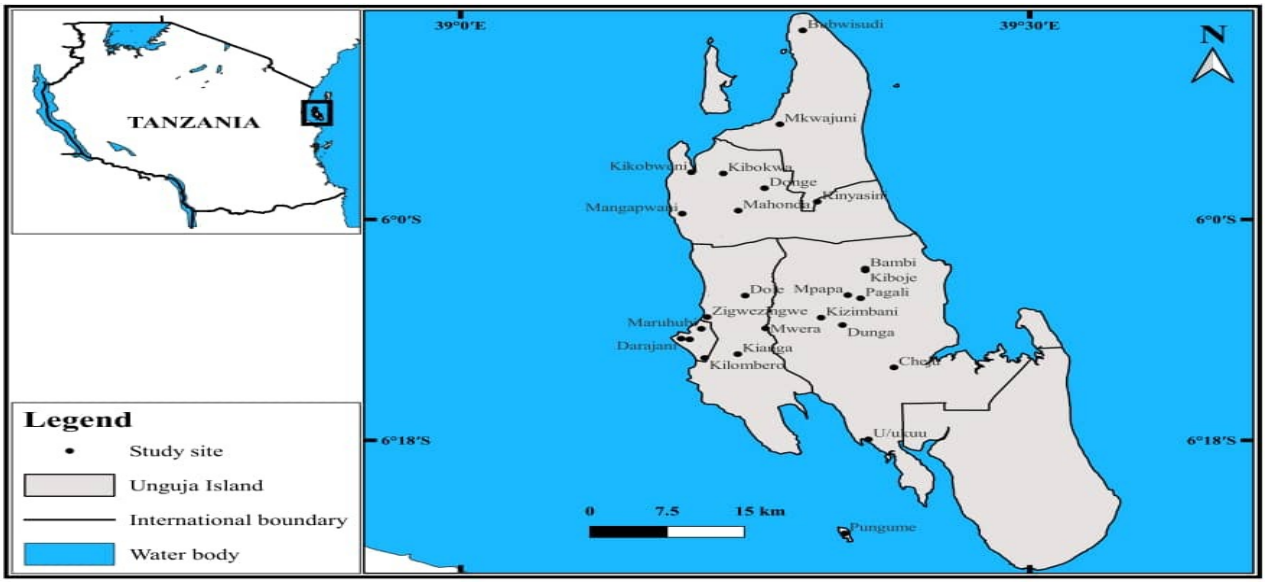
The study was conducted in Unguja, Zanzibar (Figure 1). Unguja (1666 km^2) and Pemba (988 km^2) are the two largest islands in Zanzibar. Bigger Unguja has population of 896 721 (NPHC, 2012), with an annual population growth rate of 2.8%. The major economic activities in Zanzibar are agriculture, tourism and fishing. Agriculture being the mainstay of Zanzibar's economy with a contribution tothe national Gross Domestic Product (GDP) estimated at 26.9% (The Economic Survey 2020). 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.

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 (NPHC, 2012). To determine an appropriate sample size for the study, Slovin's equation was used with a 95% confidence level (Tejada and Punzalan, 2012) which yielded an estimated sample size of 200 respondents. This was calculated using the formula $n=N/ (1 + Ne^2)$, 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)

Figure 1

The distribution of six districts with different shehia



Data collection

The target study population were farmers, livestock keepers and fishermen and other people engaging in animal related occupational activities. A structured questionnaire was used to collect information on the community regarding awareness, knowledge, attitudes and practices related toleptospirosis in rodents and domestic animals. The respondents who were illiterate underwent verbal interview to collect useful information. Each respondent was provided with a consent form to ask for his/her willingness to participate in the study. The Swahili translated structured questionnaire after being pretested to check for accuracy was administered to the respondents. The collected information included: demographic information (sex, age, educational level, occupation and location), knowledge of etiology, transmission, clinical signs, practices and knowledge of owners about animal and human leptospirosis. Household data collection included: livestock ownership and agricultural characteristics such as types and numbers of animals kept at the surrounding compound, type of crops grown in the surrounding compound, rodents presence and diversity, frequency of rodent inside the house, food stores and animal housing, evidence of rodent damage to stored food, people eating rodents, diversity and abundance in different seasons of the year and rodent control practices. Furthermore, questions concerning the physical infrastructure of the compounds such as building material of house, source of drinking/ bathing/ sanitation and flooding

Data management and Statistical analysis

The data were stored into the spreadsheet of Microsoft Excel Window 2007 and analyzed using Statistical Package for Social Sciences (SPSS) version 25.0. (IBM, 2022) The Chi-square test was employed as the analytical tool to determine the existence of statistically significant differences ($p \leq 0.05$) 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.

Ethical consideration

The research ethical approval of this study were approved by Sokoine University of Agriculture (Ref. No. SUA/ADM/R.1/8/779 and Ref. No. DPRT/SUA/R/186/F.7) and permission to conduct this study in Zanzibar was granted by the Office of the Second Vice President of Zanzibar (Ref. No. OMPR/M.95/C.6/2/VOL.XVIII/187). The consent form was usedto seek for willingness of the respondents to participate in the study prior to the startup of data collection

Results

Demographic characteristics of the respondents

A total of 200 respondents were interviewed in this study of which 67.5% and 32.5% werefrom Peri-urban and Urban areas respectively. Out of the 200 respondents interviewed, 65% (130)were

male and 35% (70) were female. The mean age of the respondents was 38.4 years and a higher proportion of them were aged 28 to 37 years (36%). In terms of education, a higher proportion of the respondents had secondary school education (61%) and the majority were farmers (35.5%), as shown 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

General knowledge regarding leptospirosis

Out of 200 respondents, 176 (64%) were not aware of the etiology of leptospirosis, while 72 (36.0%) were aware of the etiological agents of leptospirosis. When respondents were asked about the symptoms of leptospirosis, the majority of them reported high fever (33.0%, n=66), headache (21.0%, n=42) and muscle aches (13.5%, n=27) (Table 2). When asked about the way a person gets leptospirosis, the majority stated contact with water contaminated with urine/animal tissue as being a source of contamination for humans (36.5%, n=73). Others incriminated eating food contaminated with urine/animal tissue (31.5%, n=63).

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

Attitude and practices regarding leptospirosis

The respondents' attitude towards leptospirosis, when asked about treatment of drinking water at the household the majority of the respondents, (65.0%, n=130) agreed. When respondents were asked about "eating of rodents. The participants, 83.5%, (n=167) disagreed. When participants asked about whether "leptospirosis could be transmitted from animal to human, through the urineof infected animal" 55%, (n=110) agreed. When respondents asked about "rodents, domestic andwild animals as carriers of the bacteria". The majority of the participants, 64.5%, (n=129), agreed.When respondents were asked about "farmers, sewer workers, slaughterhouse, veterinary and animal caretakers, fish workers, mine workers and dairy farmers being at high risk of exposure to leptospirosis" 75%, (n=150) of respondents agreed. Notably, the study found that awareness of leptospirosis was statistically significant ($p \leq 0.05$) with respect to the respondents' attitudes as shown in Table 3 below.

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, veterinaryand animal caretakers, fish workers, mine workers and dairy farmers are at risk of exposure to Leptospirosis		
Strongly disagree	2	1.0
Disagree	2	1.0
Moderate	46	23.0
Agree	126	63.0
strongly agree	24	12.0

Strongly agree and agree are combined together as agree and strongly disagree and disagree are combined as disagreed

Awareness of leptospirosis according to the age group of respondents

The age group of 28 to 37 years (27.93%) had good knowledge of leptospirosis compared to 38 to 47 years (27.14%) and 48 to 57 years (26.54%), 58 and above years (26.43%) and 18-27 years (24.86%). The awareness of the disease with respect to age group was not statistically significant possibly because of unfamiliarity with the disease, ($p>0.05$). The age groups under 58 years were more aware of the causative agents of leptospirosis, transmission and clinical symptoms than the age group of over 58 years (Table 4).

Awareness of leptospirosis according to locations

Generally, a high proportion of peri-urban respondents (28%) were aware of leptospirosis (*Homa ya Mgunda*) compared to Urban respondents where the proportion was 24%. This is possibly due to high population of respondents and risk factors being from peri-urban areas. The knowledge on transmission and causative agents of leptospirosis was not statistically significant ($p>0.05$). Respondents from Peri-urban areas were more aware of clinical symptoms of leptospirosis compared to those from urban areas. The difference in awareness between these two locations was statistically significant ($p<0.05$) (Table 5).

Awareness of leptospirosis according to occupation status

Results show that fishermen (30.2%) were more aware of leptospirosis followed by farmers (27.6%), self-employed (26.4%), students (26%), livestock keepers (25%) and employed 24.9% respectively. The proportions were almost the same showing that awareness of leptospirosis with respect to occupations was not statistically significant ($p>0.05$) (Table 6).

Awareness of leptospirosis according to educational level

The results show that, respondents with college or university level (42.3%) were more knowledgeable of leptospirosis compared to those with lower educational levels: primary level (26.7%) and secondary education level (26.4%) respectively. The proportions were almost similar showing that awareness of leptospirosis with respect to educational level was not statistically significant ($p > 0.05$) (Table 7). This means that the knowledge and awareness was low in differentlevel of education.

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 aetiology 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)		
	Contact food contaminated with urine/animal tissue	10(21.7)	24(36.4)	17(42.5)	5(17.9)	7(35)	22.7	0.121
	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)		

Awareness of leptospirosis according to sex

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.

Awareness of practices regarding leptospirosis

Intensive system or zero-grazing was commonly practiced in Unguja island, and the majority of respondents reported tethered grazing system (51%) being commonly practiced. Most of the animals were aged between 1 to 5 years (94.5%). Cattle were mostly kept within the compound (47%) and three quarter of the animals were born in Zanzibar (75%) with the exception of sheep that were imported from the mainland, 86.5% were locally. The majority of respondents reported evidence of rodents in their houses less than once a week (30.5%), more than once a week (28.5%) and every day (27.5%). The majority of respondents used piped water in their homes (71.5%) and most of them reported that their source of drinking water was infrequently or never treated (40%),metal sheets was the major roofing material of their houses and floor and wall materials well madeof cement (90.5%). The majority of the respondents (96%) used some forms of rodent control in their households. These included, chemicals such as rat poisons (39%) followed by biological control (38.5%) such as dogs and cats. The majority of participants reported that rodents were seenin both wet and dry season (59.5%), as shown in Table 9.

Table 5

Awareness on leptospirosis according to location

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 getleptospirosis?	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)		

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 aetiology 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)	23.223	0.278
	Contact food contaminated with urine/animal tissue	29(40.8)	12(26.7)	10(28.6)	5(25)	2(11.1)	5(45.5)		
	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 symptoms of Leptospirosis?	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)		

Table 7

Awareness of leptospirosis according to educational level

Knowledge regarding leptospirosis		Primary school, n=46	Secondary school, n=122	College or university, n=26	Chi-square	P-value
Knowledge on aetiology Leptospirosis disease is a?	Bacterial-disease	12(26.1)	46(37.7)	11(42.3)	12.211	0.429
Knowledge on transmission	Contact with water contaminated with urine/animal tissue	19(41.3)	42(34.4)	10(38.5)	3.784	0.987
How does a person get leptospirosis?	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)		

Table 8

Awareness of leptospirosis according to gender

		correct answer (frequency and percentage)			
Knowledge regarding to	leptospirosis	Male, n=130	Female, n=70	Chi-square	P-value
Knowledge on etiology	Bacterial-disease	51(39.2)	21(30)	3.91	0.418
Leptospirosis disease is a?					
Knowledge on	Contact with water	36(27.7)	37(52.9)	15.782	0.003
Transmission	contaminated with				
How does a person get	urine/animal tissue	49(37.7)	14(20)		
leptospirosis?	Contact food contaminated				
	with urine/animal tissue				
	Contact with soil contaminated	19(14.6)	12(17.1)		
Knowledge on clinical	with urine/animal tissue	45(34.6)	21(30)		
	High fever				
symptoms, what are the	Headache	28(21.5)	14(20)	1.075	0.956
symptoms of	Muscle aches	17(13.1)	10(14.3)		
leptospirosis?					

Table 9

General awareness of practices regarding to leptospirosis

		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 ‘e.g. traps	42	21.0
	Chemical ‘e.g. poisons	78	39.0
	Biological ‘e.g. keeping predators	77	38.5
‘Rodent carcasses’	Leave them where they die	8	4.0
	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

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 Mgode *et al.,* (2015) in Tanzania. 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 (Nozmi *et al.,* 2018). 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 (Mgode *et al.,* 2017).

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 (Motto *et al.,* 2021) and the resemblance of its symptoms with Malaria. Moreover, 36.5% of the respondents mentioned contactwith 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 attitudeshould be complimented with awareness and knowledge, to ensure the individual practicesintervened with control measure (Arbiol *et al.,* 2016). Education level had significant relation withpreventive 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 associatedwith the disease compared to those with lower level of education (Mgode *et al.,* 2017).

A large number of participants reported seeing many rodents and their droppings inside and aroundtheir houses on a regular basis. Evidence of rodents near the house and peridomestic have been reported by Halliday *et al.,* (2013) 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. Thisresult is similar to the one conducted in Eastern Tanzania (Chipwaga *et al.,* 2014), which found similarly 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 proportions of 35.5%, 11.5% and 7.5% respectively. This findingis 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 (Schoonman and Swai, 2009).

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. Furthermore, most of the women's time is spent indoor, thus reducing their risk of contracting disease compared to males (Sadiki *et al.,* 2022). This study echoes the study by Goris *et al.,* (2013), 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 thanmale because females were more concerned with daily hygiene than males (Haake and Levett, 2015; Abu-Bakar, 2018).

In this study, 86.5% of the respondents mentioned rat sighting in the compounds, rodents dropping on top of shelves where food were 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 rats 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*) given' its publicity indifferent media. This finding is similar with that from other studies (Ricardo *et al.,* 2018; Abiayi *et al.,* 2015).

The rodent's species prevalence of 9.67% reported by Mlowe *et al*., (2023) imply that rat that 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 Maze *et al.,* (2018), who found an association between cattle contact and people.

Some respondents mentioned tethering method (51%) as the common grazing practice in Zanzibar, and 86.5% respondents indicated that indigenous cattle (zebu breeds) are kept using these 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 (Akil *et al.,* 2007). Therefore, there is no pure pastoral system in Zanzibar and food vendorsand 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 (Waridi, 2009). Subsequently, only a small percentage of the animal's population are vaccinated against leptospirosis (Mgode *et al.,* 2021).

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 (Tambi *et al.*, 2019), it is important to implement management practices such as rats' control to prevent animals from getting into contact with contaminated water sources. Also, there is a dire need to avail treatment and vaccination to ensureanimal productivity.

Conclusion

This study has shown a low level of community knowledge and awareness regarding the etiology, mode of transmission and signs of leptospirosis. This poor knowledge was seen among livestock keepers, farmers, fishermen and health care providers. Also, most of the respondents had favorable attitude, but low level of knowledge and good practices, suggesting that to ensure the individual engagement in preventive measures, the favorable attitude should be complimented with level of awareness and knowledge. Overall, 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. Finally, 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.

Conflict of Interest

We declare that no conflict of interest exists for this article.

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