Knowledge and Attitude of the Local Community Towards Cutaneous Leishmaniasis in Rural Endemic Areas in Southwestern Yemen

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Abstract

Background

Cutaneous leishmaniasis (CL), a historically neglected tropical disease, represents a significant public health problem in many endemic countries including Yemen. The ongoing armed conflict that started in March 2015 has had a negative impact on the entire healthcare system including infectious disease control programmes. Therefore, this cross-sectional study aimed to assess the knowledge and attitude towards CL among endemic communities in southwestern Yemen.

Methods

Five hundred households in five areas of Shar'ab district of Taiz governorate were randomly selected to participate in a quantitative survey. A pretested structured questionnaire was used to collect information on the participants' sociodemographic background and their knowledge and attitude towards CL and the sand fly vector.

Results

The analysis was conducted on a final sample of 466 individuals. Although the participants were aware of CL, about three quarters (77.7%) of them had poor overall knowledge about disease transmission, clinical presentation, treatment and prevention. Interestingly, about half of the participants (49.1%) were able to differentiate sand flies from other flies and mosquitoes; however, only 14.8% of the participants knew about the role of the phlebotomine sand fly in the transmission of CL. Similarly, the participants had poor overall knowledge about sand fly breeding sites, biting time and control measures. Although 44% of the participants considered CL to be more dangerous than malaria, only 36.6% believed that CL can be prevented and 76.4% had a negative attitude towards the disease. Univariate and multivariate analyses showed that age and gender were the significant determinants of knowledge about CL and the sand fly vector among the studied population.

Conclusion

A poor level of knowledge about the different epidemiological aspects of CL was found among the rural population in Taiz. This factor, together with the major collapse of the healthcare infrastructure and the paralysis of health authorities since the beginning of the ongoing civil war in Yemen, may be contributing to the continued endemicity of CL in the area. Hence, health education on CL transmission and prevention should be provided to the targeted communities.

Background

Cutaneous leishmaniasis (CL) is a vector-borne infectious disease caused by the haemoflagellate protozoan of the *Leishmania* (*L.*) genus (family *Trypanosomatidae*) and is transmitted by the bite of infected female phlebotomine sand flies. The main implicated *Leishmania* species are *L. major, L. tropica*

and *L. aethiopica* [1]. Incidences of CL occur in more than 89 countries and three territories in five continents, particularly in the tropics and sub-tropics [2]. Globally, there are an estimated three quarters to one million new cases annually, with 350 million people at risk of infection from all CL forms [2, 3]. Cutaneous leishmaniasis is largely distributed around the Mediterranean basin, the Middle East, the Horn of Africa, and the Indian subcontinent [3]. Clinically, CL is a spectral and extremely stigmatising disease that predominantly affects the face and exposed parts of the body. It usually presents as single or multiple nodules and ulcers on the skin [1]. Although CL is generally not fatal, clinical symptoms can lead to serious disfiguring scars that lead to social stigmatisation and psychological suffering as well as financial loss [4]. Cutaneous leishmaniasis is considered a neglected tropical disease in that policymakers and public health professionals are not making enough effort to control its prevalence [3].

In Yemen, although the first report of CL was documented in 1933, and the disease represented about 5% of skin diseases [5, 6], little is known about the epidemiological features and temporospatial evolution of the disease. Previous studies have revealed that CL is mainly endemic in the northwestern, southwestern, and central highland areas of the country [7–10]. According to the World Health Organisation (WHO), 4,763 CL cases were reported in Yemen in 2018 [11]. The main causative species is *L. tropica*, with *Phlebotomus arabicus* implicated as the potential vector [12] and rock hyrax as the reservoir host [7]. Hajjah and Al-Bayda governorates in the northwestern and central highlands, respectively, have been found to have the highest number of reported cases [6, 7] while Lahj and Taiz governorates have been reported to have the highest number of reported cases in the southwestern region [8–10].

Since early 2015, the civil war in Yemen has resulted in the deterioration of the healthcare infrastructure, a breakdown in the delivery of control programmes, the collapse of the healthcare system, and a shortage in the health workforce, and has impeded access to healthcare facilities [13]. Consequently, the incidence of CL has increased rapidly and new foci of transmission have also been reported, especially in the northwestern region [7]. Consequently, in the absence of a robust healthcare infrastructure and effective surveillance system, urgent action is required to curtail the incidence and spread of this infectious disease.

Many studies have revealed that an effective way of tackling infectious diseases is to improve community knowledge and attitude as these attributes play an important role in preventing and controlling such diseases. Although numerous studies have been carried out in different endemic regions worldwide to assess knowledge and attitude towards CL among various populations, to the best of our knowledge, no previous study has been conducted in Yemen. Therefore, the current study aimed to evaluate the knowledge and attitude towards CL among the rural population in five CL endemic areas of Shar’ab district in the Taiz governorate in southwestern Yemen. It is hoped that the study will provide valuable data that can be utilised in the development of an effective control strategy to eliminate the transmission of this neglected tropical disease in rural Yemen.

Materials And Methods

Study area

A cross-sectional survey-based study was carried out in five areas of Shar'ab district in Taiz governorate, namely, Nakhla, Alamjood, Bani-Ziad, Bani-Sarry and Bani-Wahban (Fig. 1). Taiz governorate (44.01° E, 13.34° N) is located in the southwestern part of Yemen, 280 km from Sana'a, the capital. Shar'ab district was selected because a recent study confirmed that it is endemic for CL [10]. The five abovementioned areas of Shar'ab district were selected because the same study showed that these areas had the highest prevalence of CL infection [10]. At the administrative level, Shara'b is divided into two subdistricts: Shara'b As-Salam district with an area of 210 km^2 and population of 146,650, and Shara'b ar-Rawnah district with an area of 417 km^2 and population of 186,955. Topographically, Shara'b district is mountainous with some valleys, and lies at an altitude of approximately 2,000 m above sea level. Some aqueducts can be found near the villages in the district and water is permanently present in these aqueducts throughout the year. The climate in this highland district can be described as varying between wet and arid, with an annual rainfall of 600–800 mm. It is cold in winter and warm in summer, with a mean annual temperature of approximately 23 °C.

Study population

Five hundred households were invited to participate in the study. The household was the sampling unit as decision making takes place at the household level. In each area, the households were selected randomly according to the probability proportional to size sampling method. During the research team visits to the study areas, the heads of household, or another member if the head was not available, were invited to participate in the study. Verbal consent was obtained from each participant after they had been provided with an adequate explanation of the nature and objectives of the study. Only those who agreed to participate were interviewed. The study protocol was approved by the Medical Ethics Committee of the University of Taiz, Yemen. The principal investigator coordinated the interview process and also conducted daily spot-checks and reviews of the completed questionnaires to ensure the completeness and consistency of the collected data.

The minimum sample size required for this survey was calculated according to the WHO's practical manual for sample size determination in health studies [14]. As previous data on the knowledge and attitude towards CL in Yemen were unavailable, a 50% level of knowledge was considered, with a 95% confidence level and 5% level of significance. Thus, 384 was yielded as the minimum number of participants required for the study. However, in order to achieve this sample size and to avoid the potential exclusion of some participants due to their refusal to participate or missing information in the completed questionnaires, a total of 500 households was targeted and used for the probability proportional to size sampling method.

The design, setting, analyses and reporting of the present study adhered to the STROBE guidelines for cross-sectional studies in epidemiology (see Additional file 1 for the detailed checklist of STROBE criteria [15]).

Data collection

Data collection was carried out over a period of four months from February to May 2019. A pretested structured questionnaire was utilised to collect information on the participants' knowledge and attitude towards CL and the sand fly vector as well as their sociodemographic information. The questionnaire was prepared after an adequate literature review of similar studies in other countries. In addition, some meetings were held with researchers, local healthcare staff and community members to identify the terms and questions that could be used for disease description. The questionnaire was designed in the English language and then translated into Arabic (the participants' native language), and the local name (*Athrah*) for CL was used to refer to the disease.

The questionnaire was composed of four sections (see additional file 2 for the questionnaire used in this study). Section 1 consisted of questions to obtain the sociodemographic characteristics of the participants, such as age, sex, education level, occupation and number household members. Section 2 on knowledge about CL contained questions that were developed to understand the participants' ability to identify the disease, its signs and symptoms, the vector for the disease, peak time of incidence, treatment options, and prevention measures. Section 3 on knowledge about sand flies comprised questions that were designed to determine the participants' ability to identify and differentiate sand flies from other flying insects, as well as the breeding sites, time of biting and the disease(s) that may be transmitted by sand flies. Section 4 on attitude towards CL contained questions on the severity of the disease in comparison with malaria, method of treatment and curability of the disease. A final question on the source of the participants' information was also included at the end of this section. Most questions were open-ended in order to avoid any false impressions due to guessing. However, some questions were presented with three options: 'no', 'yes' and 'I don't know'. The participants were interviewed face to face in their household setting by three assistants who had received adequate training on the administration of the questionnaire and on the purpose of the study.

Data analysis

Data were entered into Microsoft Office Excel spreadsheets and checked for accuracy and completeness by two research assistants. Data analysis was done using SPSS version 18 (IBM Corporation, New York, USA). Descriptive statistics such as frequencies, percentages and means were used to describe the knowledge and attitude components and the explanatory variables. The chi-square test was used to examine the association between the good knowledge scores and explanatory variables such as age, sex, education level, occupation and household size. Then, multivariate logistic regression analysis was performed to identify the significant determinants of good knowledge of CL and the sand fly vector, where a P level ≤ 0.25 in the univariate analysis was considered as the criterion for the inclusion of variables in the multiple logistic regression models [16]. Adjusted odd ratios (AORs) and their corresponding 95% confidence intervals (CIs) were calculated based on the final models. The significance level for all tests was set at $P < 0.05$.

The participants' knowledge and attitude were scored according to the method described previously by Saleh et al. [17], with some modifications to fit the studied disease. Briefly, each correct response to a question was assigned a score of 1 and each incorrect or unsure response was assigned a score of 0.

The participants' knowledge about CL was assessed based on the responses given to five items. The correct answers to these five items are as follows: 1) a symptom of CL is skin ulcer, skin wound or skin scar; 2) CL is transmitted through sand fly bites; 3) the peak of CL incidence is summer; 4) CL can be treated by herbal medicine, chemotherapy, or cauterisation; and 5) preventive measures include treating patients, vector control and improving awareness. Thus, the total knowledge score ranged from 0 to 5. Knowledge scores between 0 and 3 were considered to indicate poor knowledge while scores of more than 3 were considered to denote good knowledge.

Five items were also used to determine the participants' level of knowledge about the sand fly vector. The correct responses to the five items are as follows: 1) the sand fly is the vector of CL; 2), the biting time is at night; 3) the breeding sites are holes in dry trees, and cattle and sheep dung; 4) the methods of control include using bed nets and insecticides and minimising close contact with animals by situating animal stables as far as possible from dwellings. As above, the total knowledge score for the sand fly vector ranged from 0 to 5 with a score of 0 to 3 indicating poor knowledge and a score above 3 indicating good knowledge.

As for the participants' attitude towards CL, this was assessed based on their responses to four questions, The correct answers are as follows: 1) CL is less dangerous than malaria; 2) CL can be treated; 3) CL can be prevented; and 4) CL cannot be transmitted by direct contact with an infected person. Each correct answer to an attitude question was given a score of 1. An attitude score between 0 and 2 was considered to denote a negative attitude, whereas a score from 3 to 4 was considered to represent a positive attitude.

Results

A total of 500 participants were recruited for the study, 34 of whom were excluded due to incomplete data. Hence, the data on 466 participants were included in the final analysis.

Sociodemographic characteristics

Of the 466 participants included in the final analysis, 62.7% were male and 37.3% were female. Most of the participants (65.7%) were aged between 18 and 40 years while 34.3% were older than 40 years. In respect of education level, 21.5% of the participants were noneducated while 39.7% had completed a secondary school level of education. Just over half (53.2%) of the participants were university students while 19.3%, 14.8% and 7.5% were teachers, farmers and housewives, respectively. Most of the interviewed households (53.0%) were composed of 5–9 members. Table 1 provides the general characteristics of the study participants.

Table 1
General sociodemographic characteristics of the study participants (n = 466)

Variables	Study location					Total n (%)
	Bani-Ziad n (%)	Bani-Sarry n (%)	Nakhla n (%)	Bani-Wahban n (%)	Al-Amjood n (%)	
Age (years)						
18–40	53 (67.1)	56 (59.6)	84 (89.4)	80 (80.8)	33 (33)	306 (65.7)
> 40	26 (32.9)	38 (40.4)	10 (10.6)	19 (19.2)	67 (67)	160 (34.3)
sex						
Male	50 (63.3)	59 (62.8)	50(53.2)	55 (55.6)	78 (78.0)	292 (62.7)
Female	29 (36.7)	35 (37.2)	44(46.8)	44 (44.4)	22 (22.0)	174 (37.3)
Educational level						
Non educated	14 (17.7)	18 (19.1)	8 (8.5)	11 (11.1)	49 (49)	100 (21.5)
Primary	17 (21.5)	30 (31.9)	17 (18.1)	11 (11.1)	9 (9)	84 (18.0)
Secondary	33 (41.8)	21 (22.3)	63 (67)	46 (46.5)	22 (22)	185 (39.7)
Tertiary	15 (19.0)	25 (26.6)	6 (6.4)	31 (31.6)	20 (20)	97 (20.8)
Occupation						
Students	40 (50.6)	49 (52.1)	72 (76.6)	58 (58.6)	29 (29)	248 (53.2)
Employees	17 (21)	21 (22.3)	12 (12.8)	19 (19.2)	21 (21)	90 (19.3)
Housewives	6 (7.6)	11 (11.7)	5 (5.3)	2 (2)	11 (11)	35 (7.5)
Farmers	6 (7.6)	7 (7.4)	4 (4.3)	13 (13.1)	39 (39)	69 (14.8)
Not working	10 (12.7)	6 (6.4)	1 (1.1)	7 (7.1)	0 (0)	24 (5.2)

Variables	Study location					Total n (%)
No. of household members						
< 5	18 (22.8)	22 (23.4)	13 (13.8)	23 (23.2)	11 (11)	87 (18.7)
5–9	49 (62.0)	41 (43.6)	34 (36.2)	49 (49.5)	74 (74)	247 (53.0)
> 9	12 (15.2)	31 (33.0)	47 (50.0)	27 (27.3)	15 (15)	132 (28.3)

Knowledge about cutaneous leishmaniasis

Table 2 shows the results for the participants' knowledge about the signs and symptoms, transmission, prevention and treatment of CL. The results showed that 76% (364/466) of the participants had seen a CL case before. When participants were asked about the signs and symptoms of CL, 59.8% (279/466) correctly answered that skin infection is the main symptom of CL by using different terms such as skin wound, skin ulcer and skin scar while 40.2% were either unable to mention any signs or symptoms of CL (25.3%) or mentioned nonspecific symptoms (14.9%). With regards to mode of transmission, only 12.9% (60/466) knew that CL is transmitted by sand flies while 61.4% (286/466) were unable to mention any mode of CL transmission. Moreover, 25.7% of the participants demonstrated misconceptions about the transmission of CL, mentioning mosquitoes, autoinfection, and direct person-to-person contact. The results also showed that 35.2% of the participants correctly stated that the peak incidence of CL occurs in summer while 47.0% did not know the main transmission season.

Table 2
Knowledge about cutaneous leishmaniasis among the study participants (n = 466).

Variables	Response categories	n (%)
Have seen individuals infected with CL	Yes	354 (76.0)
	No	112 (24.0)
Signs and symptoms of CL	Skin ulcer	184 (39.5)
	Itching and redness	59 (12.7)
	Skin wound	51 (10.9)
	Skin scar	44 (9.4)
	Others	10 (2.1)
	I don't know	118 (25.3)
Mode of transmission of CL	Sand fly biting	60 (12.9)
	Bites of mosquito & other flies	67 (14.4)
	Auto-infection	15 (3.2)
	Microorganisms	11 (2.4)
	Others	27 (5.8)
	I don't know	286 (61.4)
Period of CL incidence peak	Winter	79 (17.0)
	summer	164 (35.2)
	Autumn	2 (0.4)
	Spring	2 (0.4)
	I don’t know	219 (47.0)
Treatment options of CL	Herbal medicine	167 (35.8)
	Chemotherapy	92 (19.7)
	Cauterizing	10 (2.1)
	Self-heal	5 (1.1)
	Not treated	5 (1.1)
	Others	2 (0.4)
	I don't know	185 (39.7)
Preventive measures of CL	Treating patients	93 (20.0)

Variables	Response categories	n (%)
	Eradicating vector	34 (7.3)
	Isolating patients	18 (3.9)
	Improving awareness	25 (5.4)
	Others	11 (2.4)
	I don't know	285 (61.2)

Also, 35.8% of the participants correctly believed that herbal medicine is the method of treatment while 19.7% and 2.1% correctly believed that chemotherapy and cauterisation are methods of treatment for CL, respectively. As regards prevention, the majority of the participants (62.9%) could not cite any preventive measure against CL while 20% and 7.3% mentioned correctly that treating infected patients and controlling the sand fly vector are preventive measures.

With regards to their sources of information, the majority of the participants (74.5%, 347/466) had heard about the disease through their families, relatives, and friends while 17.8% (83/466) had a history of infection. A further 6.2% (29/466) and 0.8% (4/466) participants had heard about CL at educational institutions and via the media, respectively.

As shown in Table 3, the majority of the participants (77.7%) had an overall poor knowledge about CL.

Table 3
Scores of knowledge and attitude towards cutaneous leishmaniasis and knowledge towards sand fly vector among the participants (n = 466)

Characteristics (Total score possible)	Knowledge and attitude scores (interpretation)	n	%
Knowledge towards CL (5)	0–3 (poor)	362	77.7
	4–5 (good)	104	22.3
Knowledge towards sand fly (5)	0–3 (poor)	312	67.0
	4–5 (good)	154	33.0
Attitude about CL (4)	0–2 (negative attitude)	356	76.4
	3–4 (positive attitude)	110	23.6

Knowledge about the sand fly vector

Table 4 contains the results for the participants' knowledge about sand flies and their role in disease transmission. Interestingly, about half of participants (49.1%) were able to identify and differentiate sand flies from other flies. However, only 14.8% (69/466) of the participants mentioned that CL is transmitted by sand flies.. While the majority of the participants (63.5%) did not know whether sand flies can transmit diseases, 13.7% of the participants answered that sand flies can transmit malaria.

Table 4
Knowledge about sand fly vector among the participants (n = 466)

Variables	Response categories	n (%)
Can you identify and differentiate sand flies from other common flies and mosquitoes?	Yes	229 (49.1)
	No	237 (50.9)
Diseases transmitted by sand flies	Cutaneous leishmaniasis	69 (14.8)
	Malaria	64 (13.7)
	Itching and allergy	18 (3.9)
	Nothing	2 (0.4)
	Others	17 (3.6)
	I don't know	296 (63.5)
Breeding places of sand flies	Swamps	53 (11.4)
	Sewers	19 (4.1)
	Cattle and sheep dung	78 (16.7)
	Dry tree holes	25 (5.4)
	Valleys	18 (3.9)
	Others	14 (3.0)
	I don't know	259 (55.6)
Biting time of sand flies	From dusk to sunrise	101 (21.7)
	Day time	53 (11.4)
	Any time	29 (6.2)

Variables	Response categories	n (%)
	Others	8 (1.7)
	I don't know	283 (60.7)
Methods to control sand flies	Using bed nets	106 (22.7)
	Using insecticides	48 (10.3)
	Situating animal stables as distant as possible from dwellings	12 (2.6)
	Personal hygiene	21 (4.5)
	Others	8 (1.7)
	I don't know	271 (58.2)

With regards to breeding sites, 16.7% (78/466) and 5.4% (25/466) of the participants mentioned cattle and sheep dung, and holes in dry trees, respectively, while the majority (55.6%) did not know the answer. Moreover, 21.7% of the participants thought that sand flies bite during the night-time while 17.6% thought that sand flies bite at any time of the day. The majority of the participants (58.2%) were unable to mention any control measures against sand flies while 40.1% mentioned that sand flies can be controlled by using bed nets, spraying insecticides, improving sanitation and avoiding breeding sites.

Overall, Table 3 shows that more than half of the respondents (67%) had poor knowledge about the sand fly acting as vector of CL.

Attitude towards cutaneous leishmaniasis

Table 5 gives the results on the participants' attitude to CL. A total of 205 (44%) participants considered CL to be a serious condition and more dangerous than malaria while 41.0% believed that CL is a mild infection. Interestingly, the majority of the participants (82.8%) showed a positive attitude and thought that the disease is curable while only 3.9% believed that the disease cannot be cured. However, 61.2% of the participants believed that CL cannot be prevented. In addition, just over half of the participants (52.1%) thought that CL can be transmitted from person to person through direct skin contact.

Table 5
Attitude towards cutaneous leishmaniasis among the participants (n = 466)

Variables	Response categories	n (%)
Is CL more dangerous than Malaria?	Yes	205 (44.0)
	No	191 (41.0)
	I don't know	70 (15.0)
Is CL curable?	Yes	386 (82.8)
	No	17 (3.6)
	I don't know	63 (13.5)
Is CL preventable?	Yes	170 (36.6)
	No	285 (61.2)
	I don't know	11 (2.4)
Could CL be transmitted by direct contact from person to person?	Yes	243 (52.2)
	No	139 (29.8)
	I don't know	84 (18.0)

Overall, from Table 3, it can be seen that the majority of the participants (76.4%) had an overall negative attitude towards CL.

Factors associated with knowledge and attitude towards CL and the sand fly vector

Table 6 shows that the percentage of participants aged over 40 years who had good knowledge about CL was significantly higher than that of participants aged 18–40 years (28.1 vs. 19.3%; $P = 0.029$). Also, a significantly higher percentage of participants who had good knowledge about CL were male compared to female (25.3 vs. 17.2%; $P = 0.042$). The results in Table 6 also show that the percentage of participants who had good knowledge about sand flies was significantly higher among those aged over 40 years and farmers as compared to the younger and nonworking participants, respectively (46.4 vs. 30.9%; $P = 0.014$). Also, the percentage of participants who had good knowledge about sand flies was significantly lower among those who had completed only a primary level of education as compared to noneducated participants (22.6 vs. 40.0%; $P = 0.022$). On the other hand, the distribution of positive attitude scores towards CL among the different groups was comparable ($P > 0.05$).

Table 6
Association of participants' knowledge towards cutaneous leishmaniasis and sand fly vector with their sociodemographic factors.

Variables	Good knowledge about CL†			Good knowledge about sand fly†		
	n (%)	COR (95% CI)	AOR (95% CI)	n (%)	COR (95% CI)	AOR (95% CI)
Age (years)						
> 40	45 (28.1)	1.64 (1.05, 2.56)*	2.40 (1.05, 5.50)*	64 (40.0)	1.60 (1.07, 2.39)*	1.51 (0.75, 3.04)
18–40	59 (19.3)	1	1	90 (29.4)	1	1
sex						
Male	74 (25.3)	1.63 (1.02, 2.62)*	1.50 (0.88, 2.57)	88 (30.1)	0.71 (0.48, 1.05)	0.51 (0.32, 0.82)*
Female	30 (17.2)	1	1	66 (37.9)	1	1
Education						
Tertiary	17 (17.5)	0.61 (0.31, 1.20)	-	35 (36.1)	0.78 (0.44, 1.38)	1.41 (0.57, 3.51)
Secondary	39 (21.1)	0.76 (0.43, 1.34)	-	58 (31.4)	0.63 (0.38, 1.05)	0.71 (0.31, 1.60)
Primary	22 (26.2)	1.01 (0.52, 1.96)	-	19 (22.6)	0.40 (0.21, 0.77)*	0.43 (0.17, 1.08)
Non educated	26 (26.0)	1	-	42 (42.0)	1	1
Occupation						
Employees	21 (23.3)	1.18 (0.67, 2.07)	-	27 (30.0)	0.96 (0.57, 1.60)	0.52 (0.23, 1.21)
Farmers	20 (29.0)	1.58 (0.88, 2.85)	-	32 (46.4)	1.93 (1.13, 3.28)*	1.39 (0.66, 2.93)
Not working (students & housewives)	63 (20.5)	1	-	95 (30.9)	1	1

All values are number (%). COR, Crude odds ratio. AOR, Adjusted odds ratio. CI, Confidence interval.

* Significant association ($P < 0.05$)

† Based on scores shown in Table 3.

Variables	Good knowledge about CL†			Good knowledge about sand fly†		
No. of household members						
> 9	28 (21.2)	0.96 (0.50, 1.86)	-	41 (31.1)	0.81 (0.46, 1.44)	-
5–9	57 (23.1)	1.07 (0.60, 1.93)	-	82 (33.2)	0.90 (0.54, 1.50)	-
< 5	19 (21.8)	1	-	31 (35.6)	1	-
All values are number (%). COR, Crude odds ratio. AOR, Adjusted odds ratio. CI, Confidence interval.						
* Significant association ($P < 0.05$)						
† Based on scores shown in Table 3.						

The outcome of the multivariate logistic regression (Table 6) showed that only age and sex were significant determinants of good knowledge about CL and sand flies, respectively. Participants aged over 40 years were about two times (AOR = 2.40; 95% CI = 1.05, 5.50) more likely to have good knowledge about CL as compared to the younger participants. Interestingly, male participants were 0.71 times less likely to have good knowledge about sand flies compared to their female counterparts (AOR = 0.51; 95% CI = 0.32, 0.82). All of the other sociodemographic variables (occupation and education level) were not retained in the multivariate analysis.

Discussion

One of the most effective ways to control infectious diseases and eliminate their transmission is to improve the awareness of the population at risk in endemic communities and to mobilise them to take part in control activities [18]. To achieve this goal, it is crucial to discern the knowledge and attitude gaps in the targeted population before establishing health education interventions. Previous studies that have investigated knowledge and attitude in the health context have revealed that there is a direct relationship between the awareness of a population at risk and the adoption of effective preventive measures [19]. Moreover, such studies have helped health education policymakers to implement integrated effective disease control programmes [20].

Knowledge and attitude studies on CL vary between regions and are strongly dependent on the sociocultural setting. In the current study, knowledge and attitude towards CL in the five most endemic communities in Shar'ab district, southwestern Yemen was evaluated. The findings indicated that CL was familiar to the local targeted community. The members of the community described a CL lesion using the following terms: *Athrah* (scar), *Shiqna* (lesion that affects all family members), *Nafta* (nodular lesion) or *Bula* (wet lesion) to describe a CL lesion. Local vernacular names differ from region to region and are mostly related to the lesion morphology, the aesthetic and social stigmata associated with a disease, and

the disease course [21]. The participants in the current study considered a skin lesion on the face to be a symptom of CL.

Moreover, 76.0% of the participants had seen CL cases within the community either among family members or other persons in their vicinity. This result seems to be a direct consequence of the high endemicity of CL in the investigated areas that causes the population to be aware of the signs and symptoms of the disease. Unfortunately, the lack of previous investigations on the level of knowledge about CL and/or CL-related stigma among the Yemeni population prevents a comparison of the results of the current study with other prior findings. However, this result is aligned with those reported for the Volta region in Ghana (an endemic area) where 82.0% of participants reported having seen CL cases and that skin lesions is the main symptom [22]. In contrast, a knowledge, attitude and practice (KAP) study carried out in Alexandria, Egypt (a nonendemic area) found that the majority of the participants (90.0%) had never seen an infected person [23].

Although most of participants in current study were aware of the CL symptoms, unexpectedly, they had poor knowledge about the mode of transmission of the disease: Only 12.9% of the participants knew that the sand fly is the vector for CL. This finding is consistent with previous studies conducted in endemic areas in Ghana and Saudi Arabia [22, 24]. In contrast, a study in Northern Ecuador reported that 80.0% of the participants had knowledge about the role of the sand fly in the transmission of CL [25]. This relatively high level of knowledge might be a consequence of the high frequency of CL associated with sand fly bite history experienced by the participants in the Northern Ecuadorian study. The current findings also showed that a sizeable proportion of the participants (25.7%) had misconceptions about the mode transmission of CL, citing housefly bites and autoinfection as possible causes. This finding is in agreement with that reported for the Hail region in Saudi Arabia, where the majority of the participants exhibited misunderstandings about the transmission of CL [26]. However, a better level of knowledge about CL transmission was reported by studies undertaken in Nepal, Brazil and Iran [17, 27–29]. This variation in the knowledge level between countries could be related to sociocultural factors. It is also important to point out that the transmission cycle of *Leishmania* has particular features that differ from one endemic area to another according to the geoclimatic conditions of the study area. Hence, the extrapolation of data from one region to another is not recommended.

In the current study, the majority of the participants believed that CL is curable and about one third of the participants thought that CL is treated by herbal preparations and mentioned some traditional plants that are used to cure CL. Worryingly, some other participants recommended the application of harmful acids on lesions as a treatment for CL. These findings showed that there was a poor level of knowledge among the local community regarding the usage of modern treatment strategies. This could be a consequence of the collapse of the public health system due to the ongoing armed conflict [13]. As regards knowledge about personal preventive measures such as wearing long-sleeved clothing, using mesh over windows, and using bed nets or repellents was poor. In contrast, KAP surveys conducted in Pakistan, Ecuador and Syria revealed that local communities were aware of the preventive measures they needed to take against CL [20, 25, 30]. This knowledge was acquired from governmental mass media campaigns against vector-

borne diseases including dengue, malaria and CL, whereas in Yemen the only control programme, which only targets malaria, is largely paralysed due to the civil war.

With regard to attitude towards CL, the majority of the participants believed that CL is a serious disease and that it is more dangerous than malaria. This attitude could most likely be a consequence of the high endemicity of CL and the chronicity of the associated lesions that result in disfiguring scars. Such scars lead to serious psychological and social suffering including stigma, social exclusion and mental distress [4]. Overall, the participants involved in the current study had a negative attitude towards CL. This could be a direct consequence of a lack of access to information about CL. Unfortunately, a negative attitude may lead to a delay in seeking treatment and in the case of CL may in turn lead to complications such as deep tissue damage, secondary infections, mutilating scars and negative psychological impact.

Most of the participants in the current study were able to identify sand flies. Locally, the sand fly is named *Hass* (painful-biting dipteran) and *Katem Sout* (silent dipteran). The ability of the participants to identify this dipteran may be due to many of them living in close proximity to domestic animals and in poor housing conditions both of which are suitable environments for the breeding of sand flies. However, although the participants were able to identify and differentiate sand flies from other flies, a significant proportion of the participants did not know about the role played by the phlebotomine sand fly in the transmission of CL. Also, the majority of the participants did not have correct knowledge about the peak season of transmission, the locations of sand fly breeding sites, the biting time or control methods. A previous survey in Isfahan, Iran reported that 89.8% of the participants knew about the role of the sand fly as a vector for CL but only 13.9% had enough information on the criteria by which to differentiate sand flies from other flies [19].

Overall, the findings of the current study revealed that the rural community in Taiz governorate had poor knowledge and attitude towards CL and its sand fly vector. Interestingly, however, participants aged over 40 years had a better level of knowledge about CL compared to those aged 18–40 years. This could be attributed to the gaining of increased experience over time in respect of personal infection and/or seeing other people infected with CL. Moreover, the findings indicated that males had better knowledge about CL compared to females, which could be explained by the fact that males are more likely to be infected with CL as compared to females in the study area [10] and in the northwestern region [7]. However, the association between sex and knowledge about CL was not retained in the multivariate analysis. On the other hand, the findings also showed that female participants had a better level of knowledge about the sand fly vector compared to their male counterparts. In rural Yemen, including the study area, humans live in close contact with animals as the ground floor of dwellings are traditionally occupied by animals especially cows and some households also have space for sheep within or near the dwelling, and such conditions provide favourable breeding sites for sand flies. Women are primarily responsible for animal husbandry activities, thus they are expected to be more familiar with the presence of sand flies as compared to men. Also, although the variable occupation was not retained in the multivariate analysis, farmers were also found to have significantly better knowledge about sand flies compared to students and employees. However, those farmers did not know the role of sand flies in the transmission of CL.

The overall poor level of knowledge revealed by this study could most likely be a direct consequence of this disease being neglected by health policymakers and public health professionals and a lack of priority being given to the implementation of control measures. The situation also became more complicated in 2010 due to the Arab Spring movement and the ensuing political crisis. Since March 2015, the armed conflict in the country has led to the destruction of 55% of the healthcare infrastructure, which has had a hugely adverse impact on the implementation of control measures and on immunisation coverage [13]. Unfortunately, the ongoing civil unrest has resulted in the re-emergence and outbreak of several infectious diseases including dengue [31], diphtheria [32] and cholera [33]. Taiz, the area of interest to this study, is one of the Yemeni governorates experiencing continuous armed confrontations. It is strongly affected by the civil unrest which has led to the total collapse of the health system in the governorate.

In light of the above, this study is timely in that it is the first to provide detailed information about knowledge and attitude towards CL and its vector among the Yemeni population, specifically in Taiz. However, it should be noted that this study has some limitations that should be considered when interpreting the findings. First, as this study was cross-sectional rather than interventional, this does not allow causal inference. Second, the lack of previous investigations on awareness towards CL and CL-related stigma in Yemen prevented the comparison and evaluation of the findings with those of other relevant studies. Hence, while the findings of this study might be generalisable to all of the rural communities in the Taiz governorate that are known to be endemic for CL, further studies may be required to confirm this conjecture.

Conclusions

The current study revealed that within the rural community of Taiz, Yemen there is a poor level of knowledge about the cause, transmission, treatment and preventive measures for CL and a poor level of knowledge about the sand fly as a vector for CL. These findings would seem to be a direct consequence of a lack of attention being paid to this disease and a lack of priority being given to control measures; a situation that has been exacerbated since the beginning of the civil war in Yemen and the consequent breakdown of the health infrastructure. Thus, there is an urgent need for health education to improve awareness and correct misconceptions about all aspects of CL in order to reduce incidence and prevalence in endemic areas.

Abbreviations

CL: Cutaneous leishmaniasis; AOR: Adjusted odds ratio; CI: Confidence interval; WHO: World Health Organization.

Declarations

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Authors' contributions

TAA designed the study and supervised the survey field work and data collection. TAA, NH and HMA analysed the data, wrote the paper and approved the final manuscript.

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Availability of data and material

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The study protocol was approved by the Medical Ethics Committee of the University of Taiz, Yemen. Verbal consent was obtained from each participant after adequate explanation of the nature and objectives of the study and these procedures were approved by the Medical Ethics Committee.

Consent for publication

Not applicable.

Competing interests

The authors declare no conflict of interest.

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Figures

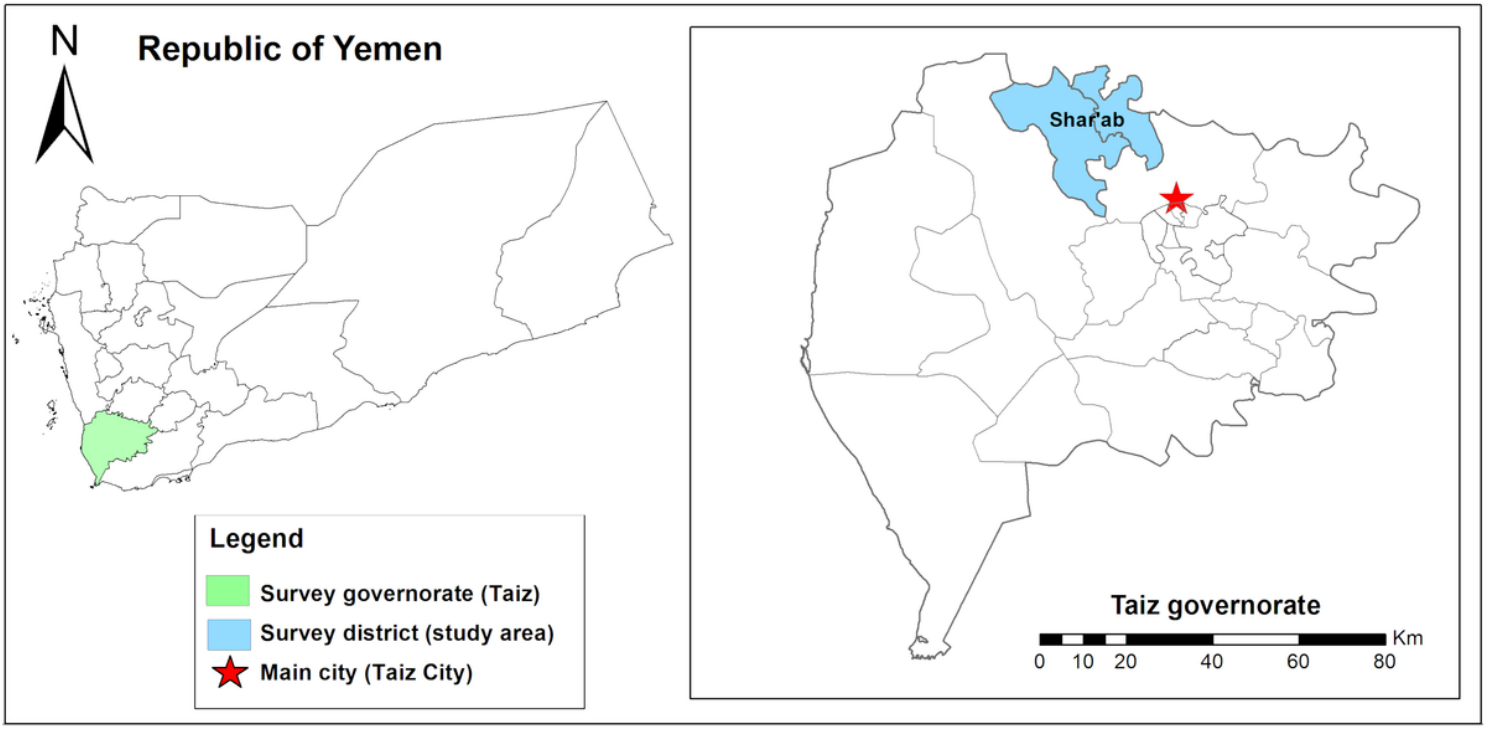

Figure 1

A geographic map showing the study area (Shar'ab district) in Taiz governorate. The map was created using the Esri ArcGIS 10.7 software. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

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