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# Knowledge and Practices Related to Dog-Associated Zoonoses in Ekiti State, Southwestern Nigeria

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## ABSTRACT

**Background:** Human-dog contact has been associated with increased risks of zoonoses. However, dog owners' knowledge and practice in preventing zoonoses transmission from dogs in Nigeria are limited. This study explored dog owners' knowledge and practices concerning zoonotic disease transmission.

**Methods:** Semi-structured questionnaires were administered to households owning dogs to assess knowledge and practice of dog-contact-associated zoonoses (DCAZ). This cross-sectional study involved mothers, fathers, and young adults who closely interacted with dogs in households in Ado, Ido, Ikole, and Oye Local Government Areas (LGAs) of Ekiti State, Nigeria, from December 2021 to May 2022. The demographic characteristics of respondents were collected for statistical analysis using the statistical package for social sciences IBM-SPSS version 25.0. The relationship between respondents' knowledge and demographic features was analysed using the Chi-square test of independence on SPSS. Results were considered significant at $p < 0.05$.

**Results:** Overall, 200 dog owners participated in the study. The mean age of participants was 32.47 (±10.99). A significant difference ($p<0.05$) was observed in the number of dogs owned per household. The knowledge of dog contact-associated zoonoses (DCAZ) was estimated at 25.5% (51/200). Association between knowledge of DCAZ and sociodemographic factors showed that age, respondents' identity, and level of education were significantly associated ($p<0.05$) with knowledge being highest among age group 41-50 and respondents with high level of education. The practices of kissing dogs, walking barefooted, eating dog meat, and respondents' preference for consumption of dog meat were observed to vary significantly among the study locations, with respondents from Ikole ranking higher at 54.0%, 50.0%, 14.0%, and 38.0% respectively ($p<0.05$). A significant difference was observed in the type of meat the respondents gave to their dogs ($p<0.05$). Overall, this study showed that 23.5% (47/200) of the respondents consumed dog meat, of which 68.1% (32/47) of the consumers showed a preference for undercooked dog meat ($p<0.05$).

**Conclusion:** This study showed the low level of knowledge regarding dog contact-associated zoonoses in Ekiti State and the need to intensify awareness of transmission routes and practices that facilitate disease transmission, utilising a One Health approach.

**Keywords:** Veterinary care, Dog's ownership, Practice, Zoonoses, Consumption

## 1.0 INTRODUCTION

Dogs have been popular companions of humans over the ages; however, their close contact with humans has been associated with an increased risk of zoonotic disease transmission to humans [1, 2]. According to the World Health Organization (WHO), zoonotic diseases are a significant cause of morbidity and mortality, resulting in 2.5 billion cases of human illness and 2.7 million human deaths worldwide annually [3]. Nigeria ranks as one of the highest countries in endemic diseases and is responsible for significant economic loss in the pathogenic spoilage of milk, contaminated animal products, carcass quality, weight loss, infertility, and loss of animal population [3, 4]. Routes of infection may be direct: through contact with contaminated environment or dogs (via licking, sneezing or coughing, petting, and physical injuries), animal urine and other body fluids or secretions, inhalation of aerosols or droplets, accidental ingestion of animal fecal materials; or indirect, (via consumption of raw or undercooked foods) [2, 5-7]. The impact of zoonotic infections may be fatal in high-risk groups (very young children, pregnant women, elderly people, and immunocompromised people) [7].

Commonly reported zoonoses associated with dogs include but are not limited to toxoplasmosis, ancylostomiasis, and toxocariasis [2,5,6]. *Toxoplasma gondii* is among the protozoan zoonotic agents commonly reported in owned and outdoor dogs [8, 9]. The transmission routes include drinking water contaminated with oocysts, consumption of raw or undercooked meat of definitive or intermediate hosts containing tissue cysts of *T. gondii*, or via the transplacental route [10]. *T. gondii* causes toxoplasmosis in congenitally infected foetuses of homeothermic species worldwide [11, 12]. The severity of fetal infection is associated with the gestational stage at the time of maternal infection, parasite burden, and genotypic characteristics [11]. Severe congenital defects such as chorioretinitis, mental retardation, and hydrocephalus, as well as preterm labour and spontaneous abortion, are often associated with *T. gondii* in pregnant women, especially during the first trimester [10].

Ancylostomiasis is caused by *Ancylostoma* species, namely (*A. braziliense, A. caninum, A. ceylanicum*, and *Uncinaria stenocephala*) of which *A. caninum* represents one of the most prevalent and pathogenic species causing acute or chronic haemorrhagic anaemia, especially severe in young pups [13]. Dogs become infected via various routes but commonly through skin penetration of larvae or faecal-oral route from contaminated environment [14]. Trans mammary transmission from an infected mother to puppies has also been reported [15]. Similarly, infection in humans occurs through intradermal penetration of *Ancylostoma* larvae from a contaminated environment, resulting in cutaneous larva migrans (CLM), also known as creeping eruption, sandworm eruption, plumber's itch, and serpiginous dermatitis [13, 16].

*Toxocara canis* is a zoonotic dog roundworm with global prevalence [17, 18]. Infection with *T. canis* or other *Toxocara* species is responsible for toxocariasis in animals and humans [18]. Dog transmission routes include vertical transmission, trans mammary transmission, and horizontal transmission [19]. Humans become infected via ingestion of eggs from contaminated environments or larvae in raw or undercooked infected food [6, 19]. Upon hatching in the small intestine, the worms migrate through the circulatory system to the liver, lungs, eyes, or central nervous system, where they cause immunopathological and mechanical damage [19]. *T. canis* infection results in visceral larva migrans (VLM), ocular larva migrans (OLM), covert toxocariasis (CT), and neurotoxocariasis (NT) [6, 19].

Generally, zoonotic infections due to these zoonotic agents (*T. gondii, Ancylostoma* sp, and *T. canis*) have been reported worldwide [20-22]. However, despite their global prevalence, studies on knowledge and practices toward dog contact-associated zoonoses (DCAZ) are limited, and few studies exist on DCAZ in Nigeria [23]. Therefore, this study was conducted to assess the knowledge and practices of dog owners toward DCAZ in South Western Nigeria.

## 2.0 METHODOLOGY

### 2.1 Study Areas

The cross-sectional study was conducted in four local government areas (LGAs) in Ekiti State, Nigeria, from December 2021 to May 2022. The LGAs include Ado, Ido, Ikole, and Oye. Ado LGA is located on latitude 7°35 and 74°47 north of the equator and longitude 5°11 and 5°16 east of the Greenwich meridian, while Ido-Osi LGA is located on latitude 7.86194 and longitude 5.18861. Ikole LGA is located on latitude 7.78333 and longitude 5.51667, while Oye LGA is located on latitude 7.88944 and longitude 5.34472. All the LGAs are within the tropics and have tropical climates.

### 2.2. Study Design

Informed consent was obtained from respondents to participate in the study, and pretested questionnaires were prepared in the local language and administered to randomly selected houses following an interview-guided approach. Respondents were assured of anonymity, and their confidentiality was maintained by using number codes on the questionnaire without using individual names. Participants were mothers, fathers, or any individual in the household older than 18 years. Data collected from the interview included socio-demographic information, knowledge, and practices of participants related to DCAZ. The demographic information of the participants interviewed included age, gender, household size, occupation, and educational qualifications of participants. Specifically, questions were asked on knowledge and practices relating to DCAZ, such as the type of food given to dogs. In this place, the food was brought, the frequency and the type of contact the owners had with their dogs, sanitation practices, their knowledge about DCAZ, and their source of information about these diseases. The questionnaire administration process took approximately 15 min for each participant.

### 2.3. Sample Size

Determination. The sample size was calculated using the following equation with a 95% confidence level n = 1.962 $pq/L^2$, where n = required sample size, p = expected prevalence (0.15), q = 1-p, and L = limits of error on the prevalence, 5%.

### 2.4. Data Analysis

Data from the questionnaire survey were recorded and analyzed using the statistical package for social sciences IBM-SPSS version 25.0. Chi-square statistic was used to determine the association between sociodemographic characteristics of respondents and the knowledge and practices relating to DCAZ. A p-value < 0.05 was considered statistically significant.

## 3.0 RESULTS

### 3.1 Sociodemographic of Respondents.

Table 1 shows the sociodemographic characteristics of study participants. Overall, 200 dog owners participated in the study. The mean age of participants was 32.47 years (±10.99). Age was statistically significant ($p<0.05$), with age groups 21-30 years and 31-40 years constituting higher percentages in all locations. Also, education showed a significant difference ($p<0.05$) in the study locations, with the majority of the respondents having high and tertiary education in all the locations (Table 1).

**Table 1.** Sociodemographic Characteristics of Respondents in Ado, Ido, Ikole, and Oye LGAs, Ekiti State.

| Variable | Ado (n=50) | Ido (n=50) | Ikole (n=50) | Oye (n=50) | Total (N=200) | P-value |
|---|---|---|---|---|---|---|
| | Freq (%) | Freq (%) | Freq (%) | Freq (%) | Freq (%) | |
| Age (years) | | | | | | |
| ≤20 | 8 (16.0) | 3 (6.0) | 5 (10.0) | 5 (10.0) | 21 (10.5) | 0.000 |
| 21-30 | 23 (46.0) | 14 (28.0) | 15 (30.0) | 30 (60.0) | 97 (48.5) | |
| 31-40 | 10 (20.0) | 15 (30.0) | 17 (34.0) | 12 (24.0) | 54 (27.0) | |
| 41-50 | 2 (4.0) | 16 (32.0) | 9 (18.0) | 0 (0.0) | 27 (13.5) | |
| 51-60 | 3 (6.0) | 2 (4.0) | 3 (6.0) | 1 (2.0) | 8 (4.0) | |
| >60 | 4 (8.0) | 0 (0.0) | 1 (2.0) | 2 (4.0) | | |
| Respondents' ID | | | | | | |
| Mother | 18 (36.0) | 21 (42.0) | 19 (38.0) | 22 (44.0) | 80 (40.0) | 0.183 |
| Father | 8 (16.0) | 10 (20.0) | 18 (36.0) | 12 (24.0) | 48 (24.0) | |
| Young adults >18 | 24 (48.0) | 19 (38.0) | 13 (26.0) | 16 (32.0) | 91 (45.5) | |
| Educational level | | | | | | |
| Primary | 8 (16.0) | 9 (18.0) | 6 (12.0) | 11 (22.0) | 34 (17.0) | 0.047 |
| High | 9 (18.0) | 22 (44.0) | 22 (44.0) | 17 (34.0) | 70 (35.0) | |
| Tertiary | 33 (66.0) | 19 (38.0) | 22 (44.0) | 22 (44.0) | 96 (48.0) | |
| Occupational Status | | | | | | |
| Employed | 12 (24.0) | 8 (16.0) | 13 (26.0) | 11 (22.0) | 44 (22.0) | 0.151 |
| Unemployed | 6 (12.0) | 14 (28.0) | 17 (34.0) | 14 (28.0) | 51 (25.5) | |
| Self-employed | 32 (64.0) | 28 (56.0) | 20 (40.0) | 25 (50.0) | 105 (52.5) | |

### 3.2. Purpose of owning dogs and knowledge of dog contact associated with zoonoses.

A significant difference (P<0.05) was observed in the number of dogs owned per household, with the majority of the households having 1, 2, or 3 dogs. Also, a significant difference (p<0.05) was observed in the purpose of dog ownership. Dogs were kept mainly to guard 46.0% (92/200) and companionship 32.0% (64/200) (Table 2).

Overall, knowledge of DCAZ was estimated at 25.5% (51/200). A significant difference was observed in the study locations, with Ikole having the highest knowledge (48.0%), followed by Ido (34.0%) and (10.0%) in both Ado and Oye LGAs (Table 2). The majority (37.3%;19/51) of respondents with knowledge of DCAZ heard through friends, while those that heard from veterinarians and health workers constituted 25.5% (13/51). Only 11.8% (6/51) reported obtaining the knowledge from media/internet.

**Table 2.** Association between the purpose of owning dogs and knowledge of dog contact-associated zoonoses in Ado, Ido, Ikole, and Oye LGAs, Ekiti State.

| Variables | Ado (n=50) Freq (%) | Ido (n=50) Freq (%) | Ikole (n=50) Freq (%) | Oye (n=50) Freq (%) | Total (N=200) Freq (%) | P - value |
|---|---|---|---|---|---|---|
| Number of dogs owned | | | | | | |
| 1 | 24 (48) | 22 (44.0) | 14 (28.0) | 20 (40.0) | 80 (40.0) | 0.034 |
| 2 | 15 (30.0) | 14 (28.0) | 18 (36.0) | 14 (28.0) | 61 (30.5) | |
| 3 | 4 (8.0) | 5 (10.0) | 15 (30.0) | 9 (18.0) | 33 (16.5) | |
| 4 | 6 (12.0) | 8 (16.0) | 3 (6.0) | 4 (8.0) | 21 (10.5) | |
| 5 | 1 (2.0) | 1 (2.0) | 0 (0.0) | 0 (0.0) | 2 (1.0) | |
| 6 | 0 (0.0) | 0 (0.0) | 0 (0.0) | 3 (6.0) | 3 (1.5) | |
| Purpose of dog ownership | | | | | | |
| Hunting | 6 (12.0) | 22 (44.0) | 8 (16.0) | 8 (16.0) | 44 (22.0) | 0.003 |
| Guarding | 24 (48.0) | 17 (34.0) | 27 (54.0) | 24 (48.0) | 92 (46.0) | |
| Companion | 20 (40.0) | 11 (22.0) | 15 (30.0) | 18 (36.0) | 64 (32.0) | |
| Knowledge of dog contact-associated zoonoses? | | | | | | |
| Yes | 5 (10.0) | 17 (34.0) | 24 (48.0) | 5 (10.0) | 51(25.5) | 0.000 |
| No | 45 (90.0) | 33 (66.0) | 26 (52.0) | 45 (90.0) | 149 (74.5) | |
| Source of information | | | | | | |
| Friends | 1 (2.0) | 8 (16.0) | 8 (16.0) | 2 (4.0) | 19 (37.3) | 0.005 |
| Veterinarians | 1 (2.0) | 4 (8.0) | 8 (16.0) | 0 (0.0) | 13 (25.5) | |
| Health workers | 2 (4.0) | 2 (4.0) | 6 (12.0) | 3 (6.0) | 13 (25.5) | |
| Media/Internet | 1 (2.0) | 3 (6.0) | 2 (4.0) | 0 (0.0) | 6 (11.8) | |

**Table 3.** Association between knowledge of dog contact-associated zoonoses and sociodemographic characteristics of respondents in Ado, Ido, Ikole, and Oye LGAs, Ekiti State.

| Variables | Knowledge of dog contact-associated zoonoses. | |
|---|---|---|
| **Age** | Yes (%) | No (%) |
| ≤20 | 3 (14.3) | 18 (85.7) |
| 21-30 | 15 (18.3) | 67 (81.7) |
| 31-40 | 15 (27.8) | 39 (72.2) |
| 41-50 | 15 (55.6) | 12 (44.4) |
| 51-60 | 3 (33.3) | 6 (66.7) |
| >60 | 0 (0.0) | 7 (100) |
| $X^2$, p-value | 19.305, P=0.002 | |
| **Respondents' ID** | | |
| Mother | 23 (28.8) | 57 (71.3) |
| Father | 19 (39.6) | 29 (60.4) |
| Others | 9 (12.5) | 63 (87.5) |
| $X^2$, p-value | 11.861, p=0.003 | |
| **Educational status** | | |
| Primary | 11 (32.4) | 23 (67.6) |
| High | 26 (37.1) | 44 (62.9) |
| Tertiary | 14 (14.6) | 82 (85.4) |
| $X^2$, p-value | 11.858, p=0.003 | |
| **Occupational Status** | | |
| Employed | 9 (20.5) | 35 (79.5) |
| Unemployed | 16 (31.4) | 35 (68.6) |
| Self-employed | 26 (24.8) | 79 (75.2) |
| $X^2$, p-value | 1.546, p=0.462 | |

### 3.3. Association between knowledge of dog contact-associated zoonoses and sociodemographic characteristics of respondents in study locations.

Significant associations (p<0.05) were found between knowledge of dog-associated zoonoses and all sociodemographic characteristics of respondents except the occupational status (Table 3). Knowledge was highest among the respondents in age group 41-50 (55.6%), father (39.6%), and high school qualification 37.1% (p<0.05) (Table 3).

### 3.4. Practices of respondents relating to DCAZ.

With regards to the practices of respondents about DCAZ, most respondents, 60.5% (121/200), they report-

ed free range mode of rearing, although the difference was not statistically significant (p>0.05). The type of food given to dogs was observed to show a significant difference among the study locations (p<0.05), with most respondents 52.0% (104/200) reporting giving human food to their dogs. In comparison, 25.5% and 22.5% reported giving meat and commercial food, respectively (p<0.05) (Table 4). Furthermore, a significant difference

**Table 4.** Respondents' practices regarding dog-associated zoonoses in Ado, Ido, Ikole, and Oye LGAs, Ekiti State.

| Variables | Ado (n=50) Freq (%) | Ido (n=50) Freq (%) | Ikole (n=50)Freq (%) | Oye (n=50) Freq (%) | Total (N=200)Freq (%) | P-value |
|---|---|---|---|---|---|---|
| Mode of rearing | | | | | | |
| Indoor | 16 (32.0) | 25 (50.0) | 23 (46.0) | 15 (30.0) | 79 (39.5) | 0.100 |
| Free range | 34 (68.0) | 25 (50.0) | 27 (54.0) | 35 (70.0) | 121 (60.5) | |
| Type of food given to dogs. | | | | | | |
| Meat | 3 (6.0) | 23 (46.0) | 11 (22.0) | 14 (28.0) | 51 (25.5) | 0.000 |
| Human Food | 28 (56.0) | 22 (44.0) | 24 (48.0) | 30 (60.0) | 104 (52.0) | |
| Commercial Food | 19 (38.0) | 5 (10.0) | 15 (30.0) | 6 (12.0) | 45 (22.5) | |
| Type of meat given to dogs. | | | | | | |
| Raw | 2 (4.0) | 10 (20.0) | 5 (10.0) | 8 (16.0) | 25 (49.0) | 0.000 |
| Cooked | 1 (2.0) | 7 (14.0) | 3 (6.0) | 5 (10.0) | 16 (31.4) | |
| Both raw and cooked | 0 (0.0) | 6 (12.0) | 3 (6.0) | 1 (2.0) | 10 (19.6) | |
| Do you take your dog to the vet. clinic for deworming? | | | | | | |
| Yes | 45 (90.0) | 44 (88.0) | 46 (92.0) | 47 (94.0) | 182 (91.0) | 0.748 |
| No | 5 (10) | 6 (12.0) | 4 (8.0) | 3 (6.0) | 18 (9.0) | |
| Frequency of deworming | | | | | | |
| Monthly | 7 (15.5) | 5 (11.4) | 10 (21.7) | 6 (12.8) | 28 (15.4) | 0.101 |
| Every three months | 3 (6.7) | 13 (29.5) | 13 (28.3) | 9 (19.2) | 38 (20.9) | |
| Every six months | 19 (42.2) | 16 (36.4) | 8 (17.4) | 20 (42.6) | 63 (34.6) | |
| Once in a year | 16 (35.6) | 10 (22.7) | 15 (32.6) | 12 (25.5) | 53 (29.1) | |
| Sleeping Place of Dogs | | | | | | |
| Living room | 6 (12.0) | 18 (36.0) | 7 (14.0) | 9 (18.0) | 40 (20.0) | 0.072 |
| Dog's house | 19 (38.0) | 15 (30.0) | 21 (42.0) | 19 (38.0) | 74 (37.0) | |
| Outdoor | 25 (50.0) | 17 (34.0) | 22 (44.0) | 22 (44.0) | 86 (43.0) | |
| Do you touch your dogs? | | | | | | |
| Yes | 46 (92.0) | 45 (90.0) | 44 (88.0) | 46 (92.0) | 181 (90.5) | 0.887 |
| No | 4 (8.0) | 5 (10.0) | 6 (12.0) | 4 (8.0) | 19 (9.5) | |
| Do you kiss your dogs? | | | | | | |
| Yes | 5 (10.0) | 19 (38.0) | 27 (54.0) | 0 (0.0) | 51 (25.5) | 0.000 |
| No | 45 (90.0) | 31 (62.0) | 23 (46.0) | 50 (100.0) | 149 (74.5) | |
| Do you wash your hands with soap and water after having contact with your dogs? | | | | | | |
| Yes | 33(18.2) | 40(22.1) | 33 (18.2) | 34 (18.8) | 140 (77.3) | 0.652 |
| No | 8(4.4) | 12(6.6) | 9(5.0) | 12(6.6) | 41 (22.7) | |
| Do you walk barefoot? | | | | | | |
| Yes | 7 (14.0) | 19 (38.0) | 25 (50.0) | 13 (26.0) | 64 (32.0) | 0.001 |
| No | 43 (86.0) | 31 (62.0) | 25 (50.0) | 37 (74.0) | 136 (68.0) | |
| Do you eat dog meat? | | | | | | |
| Yes | 0 (0) | 17 (8.5) | 28 (14.0) | 2 (1.0) | 47 (23.5) | 0.000 |
| No | 50 (100) | 33 (66.0) | 22 (44.0) | 48 (96.0) | 153 (76.5) | |
| Preference for consumption of dog meat | | | | | | |
| Under cooked | 0 (0) | 12 (24) | 19 (38.0) | 1 (2.0) | 32 (68.1) | 0.000 |
| Well cooked | 0 (0) | 5 (10.0) | 9 (18.0) | 1 (2.0) | 15 (31.9) | |

was observed in the type of meat the respondents gave to their dogs (P<0.05). Among respondents who reported giving meat to their dogs, 49.0% (25/51) gave raw meat, 31.3% (16/51) gave cooked meat, while 19.6% (10/51) of the respondents gave both types of meat to their dogs (P<0.05) (Table 4a and Table 4).

No significant difference was observed in the practice of veterinary care to dogs, frequency of deworming, sleeping place of dogs, touching of dogs, and washing of hands after having contact with dogs in the study (p>0.05). However, the practices of kissing dogs, walking barefooted, eating dog meat, and preference for consumption of dog meat were observed to vary significantly among the study locations, with respondents from Ikole ranking higher at 54.0%, 50.0%, 14.0%, and 38.0% respectively (p<0.05) (Table 4a and Table 4b). Overall, this study shows that 23.5% (47/200) of the respondents consumed dog meat, of which 68.1% (32/47) of the consumers showed a preference for undercooked dog meat (p<0.05).

## 4.0 DISCUSSION

This study aimed to understand the knowledge and practice of dog owners toward dog contact-associated zoonoses (DCAZ) in Ekiti State, Nigeria. In this study, age was found to show a significant difference among the study locations. Most respondents fall within the age groups of 21-30, 31-40, and 41-50. This is consistent with another author who reported a similar trend from dog owners [24]. This may be attributed to the fact that respondents in these categories are more agile towards providing the required dog care. Also, the significant difference observed in respondents' education in this study is consistent with the report from Wukari Metropolis, Taraba State Nigeria [24].

Regarding the number of dogs the respondents owned, our study showed that most respondents owned 1 or 2 dogs. This is consistent with a study in Awash Basin, eastern Ethiopia, that showed a significant difference in the mean number of dogs owned per household [25]. Also, the significant difference observed in the purpose of keeping dogs in this study is consistent with reports from elsewhere [2, 5]. An earlier study has associated the purpose of keeping dogs with the care and treatment the dogs receive [26]. For instance, a study showed that keeping dogs for guarding purposes contributed to increased positive care received by the dogs [27]. However, this disagrees with another study from Awash Basin, eastern Ethiopia, where guarding was the sole purpose of dog ownership, and the dogs lacked veterinary care [25].

The level of knowledge, 25.5% (51/200), of DCAZ (toxoplasmosis, ancylostomiasis, and toxocariasis) observed in this study is higher than the 4.6% reported from Addis Ababa, Ethiopia [27], 7.27% knowledge of rabies, echinococcosis, ringworm, and toxoplasmosis reported from western Ethiopia [2], as well as 10.0% and 20.0% reported from India [28, 29]. The level of knowledge is however, lower than 30.0% reported from Nyagatare district, Rwanda [5], 75.9% from western Ethiopia [2], 54.0% from Texas, United States of America [30], and 44.3% from Ambo, Ethiopia [31].

Furthermore, this study revealed that the significant source of knowledge in this study is from friends, followed by veterinarians and health workers. Only a few respondents reported acquiring knowledge from the media. This is consistent with a report from a previous study that reported friends and neighbours as their major sources of information [2, 5]. However, it disagrees with other studies from United States, Australia, and Canada that reported media outlets, professionals, and veterinarians as their main sources of knowledge respectively [30, 32, 33]. This may be attributed to the prevailing available sources in the different regions as at the time the studies were being conducted and the possible variation in the sources of animal health information due to different locations. The low knowledge of DCAZ observed from dog owners in this study is of public health concern because effective prevention hinges on adequate knowledge of disease transmission.

Association between knowledge of DCAZ and sociodemographic factors showed that age, respondents' identity, and level of education are significantly associated (p<0.05) with knowledge being highest among age group 41-50, fathers, and respondents with high level of education. The high knowledge in the age group 41-50 disagrees with earlier studies that reported poor knowledge among this age group [24, 34]. This may be attributed to the demographic variation of the study population and study location. The significant association between knowledge and fathers observed in this study is in agreement with another study [2] but disagrees with [35]. This may be associated to men involvement in keeping and managing animals [36]. Moreover, the finding from this study is consistent with those of other studies with regards to the role of education in knowledge of zoonoses

[24, 37]. The observed association between knowledge and educational level of respondents in this study may be attributed to the influence of academic training the respondents have received [31].

With regards to practice, there was no significant difference observed in veterinary care, frequency of deworming, sleeping place of dogs, touching of dogs, and hand washing after touching of dogs ($p>0.05$). However, most respondents reported taking their dogs to veterinary clinics for deworming 91.0% (182/200) more commonly every 6 months, 34.6% (63/182), and once a year 29.1% (53/182). This is higher than 29.8% and 29.6%, respectively, that were reported from Addis Ababa, Ethiopia [27] and Nyagatare district of Rwanda [5].

Also, the majority of the respondents reported that their dogs sleep outdoors 43.0% (86/200). This is higher than 11.9% reported from Addis Ababa, Ethiopia [27]. The percentage of respondents that sleep in the dog's house, 37.0% (74/200) observed in this study, is lower than 53.6% observed elsewhere [27]. Findings from this study show that most respondents reported touching their dogs 90.5% (181/200), while 25.5 % (51/200) reported the habit of kissing their dogs. This is lower than the value reported from earlier studies [27, 31]. The role of direct or indirect dog contact in the risk of contracting toxocariasis has been suggested [27, 38]. The percentage of 77.3% (140/181) of respondents that reported washing of hands with soap and water after having contact with a dog is lower than 78.8% reported from elsewhere [22] but higher than the percentages observed from similar studies [39, 40]. Hand hygiene plays a pivotal role in the control of zoonosis transmission [27]. The observed high value in this study is not far-fetched and may be attributed to the aftermath of hand-washing behaviors that accompanied the COVID-19 period [41].

Findings from this study showed that 32.0% (64/200) of the respondents walk barefoot. This is higher than the 15.1% reported from Argentina [42]. The role of walking barefoot in zoonoses transmission is well documented [43-45]. For instance, studies have shown that walking barefoot contributes to increased risks of ancylostomiasis transmission [45, 46].

Moreover, most respondents, 52.0% (104/200), fed their dogs with human foods ($p<0.05$). This disagrees with other studies that reported commercial foods [27] and raw meat as the most common food given to dogs [2]. Out of the respondents who fed their dogs with meat, 49.0% (25/51) reported giving raw meat to their dogs ($p<0.05$). This is lower than the 59.1% reported from Addis Ababa, Ethiopia [27] but higher than the 28.0% reported from Canada [33] and 44.2% reported from western Ethiopia [2]. The role of feeding dogs raw meat in zoonoses transmission cannot be overemphasized.

The percentage of respondents, 25.5%, that reported consumption of dog meat in this study is lower than the 49% (265/541) observed in Ghana [47] but higher than 7.5% reported from Imo State, Nigeria [48]. Studies have shown that consuming raw or undercooked dog meat is important in zoonoses transmission [48-50]. For instancetoxocariasis is one of the foodborne diseases reported from dog meat consumption [51, 52]. *Toxocara* larvae persist in dogs' tissues [53] and can be re-activated and resume migration, particularly if the meat is consumed undercooked [54]. However, *Toxocara* do not develop to adulthood in humans but remain as third-stage larvae in the tissues, causing varying degrees of clinical manifestations in humans [55-57]. This study emphasises the need to scale up awareness of zoonoses transmission from dogs and various transmission routes using a One Health approach. Synergetic effort involving the veterinarians, health professionals, researchers, the media, policy makers, and the community dwellers will play a major role in controlling dog contact-associated zoonoses. Policymakers in the State should make veterinary services readily available to the people by creating more veterinary clinics in all the Local Government Areas in the State. Collectively, these will enhance knowledge, foster positive attitudes, and promote good practices among dog owners and the community.

## Study Limitation

Given the cross-sectional nature of the current survey, it is impossible for us to document causal relationships. Although this study employed Chi-square tests to determine associations, the observed correlation does not necessarily imply causation due to other confounding variables that might have influenced the results.

This study showed a low level of knowledge regarding dog contact-associated zoonoses and the need to intensify awareness on transmission routes and practices that promote zoonoses transmission.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that there is no conflict of interests.

## Authors' Contributions

**AOO** conceived and designed the study, contributed to analysis of data and manuscript writing. **AO** contributed to data analysis tools and review of manuscript for methodological and intellectual contact . **AOF** contributed to data collection and data analysis tools. All authors approved the final copy of the manuscript.

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