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Research article

Zoonotic diseases risk perceptions and protective behaviors of consumers associated with consumption of meat and milk in and around Bishoftu, Ethiopia

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ABSTRACT

Consumption of raw or undercooked milk and meat is a major source of zoonoses. Information on the public risk perceptions and protective behaviors are essential for prevention and control of these diseases. However, such information is limited in Ethiopia. We assessed the risk perceptions and protective behaviors of the community toward zoonoses associated with consumption of raw meat and milk by employing the basic constructs of food safety health belief model. We collected data from 210 respondents (105 from each urban and peri-urban) using a face-to-face questionnaire interview. Majority of the respondents (96.2%) had knowledge about zoonoses. Despite their knowledge, 91% and 94.3% had raw meat and raw milk consumption habits, respectively. The odds of raw meat consumption was significantly higher in males (AOR = 3.90; CI = 1.28–11.86) and raw milk consumption was higher in females (AOR = 3.82; CI = 0.78–18.65). About 65% of respondents, obtained meat from backyard slaughtering. Self-owned and smallholder dairy farms are the major sources of milk for peri-urban and urban dwellers, respectively. While 46.7% of the respondents reported that community members are the primary sources of information, only 2.4% reported animal health professionals as their primary source of information. More than half of the respondents either moderately or strongly agreed that consumption of raw meat and raw milk can expose them to zoonoses. Urban dwellers had perceived more seriousness of consuming raw animal products. Peri-urban residents had significantly lower intention than urban ones to implement protective behaviors such as stopping consuming raw meat (P = 0.017) and milk (P = 0.043). We noted that lack of access to refrigerator and pasteurized milk were the perceived barriers for protection against zoonoses among the peri-urban dwellers. There was significant difference in perceived benefits of avoiding consumption of raw meat (P = 0.005) and milk (P = 0.001) between urban and peri-urban residents. Our study showed that irrespective of knowledge about zoonoses, consumptions of raw meat and raw milk remained common practices among the respondents. Public health education on the risk of consumption of raw milk and meat and the significance of protective behaviors using a one-health approach is critically needed to ensure meat and milk safety.

1. Introduction

The interaction between humans and animals and their surrounding environment is very close particularly in many developing countries, where animals serve as the sources of food and income to humans [1]. Consumption of raw animal products is a welcoming tradition in most of countries including Ethiopia. However, absence of proper care during production and processing can lead to a serious public health risk due to likely exposure to zoonotic pathogens that are transmitted between animals and humans [2, 3, 4]. Zoonoses are estimated to account for more than 60% of all infectious diseases and 75% of all emerging diseases of humans [5]. They are transmitted by consumption of contaminated foods and water, exposure to pathogen during preparation and processing and by direct contact with infected animals or humans [6, 7]. A number of

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zoonotic diseases including rabies, brucellosis, bovine tuberculosis, food borne infections and intoxication and echinococcosis continue to affect human and animal health in many countries, particularly in developing nations [8].

The negative effects of zoonoses are far reaching and their burden and real tragedy tend to fall most heavily on poor societies of developing countries as these countries often have inadequate awareness and infrastructure and limited financial resources to control or prevent animal diseases [9].

Consumption of meat and milk and thereof are the major sources of zoonotic diseases [10, 11]. In Ethiopia, the traditional meat sharing among groups called "*kircha*" and common practices of consumption of raw meat in the form of minced meat ("*kitfo*") and steak ("*kurt*") are very common [12, 13]. These practices had long been associated with outbreaks of zoonoses, especially anthrax [14]. Similarly, informal marketing of milk is common and milk and milk products are consumed in either raw form or traditionally processed dairy products such as yogurt, cheese, and butter [15] which is often contaminated with zoonotic and other pathogenic organisms [16, 17, 18]. According to the Ethiopian central statistical agency, only less than one percent of the milk is consumed in pasteurized form in the country signifying the high likely risk of exposure to milk borne diseases [19]. Furthermore, food safety system in Ethiopia is not well organized and developed as in developed countries. Implementation of food safety laws and regulations were basically limited to the regulatory obligations or sanitary requirements associated with import and export processes. However, there were no available evidence on the implementation, evaluation, and monitoring of the effectiveness of food safety laws and regulations in the local scenario [20, 21].

These facts, coupled with growing population, urbanization, environment and food hygiene issues, animal husbandry and food systems in the country continue to be a problem and adversely affecting the quality and safety of food supply value chains [20].

In Ethiopia, previous studies reported the occurrence of various zoonotic diseases such as bovine tuberculosis [22, 23], brucellosis [24, 25], bovine cysticercosis and/or taeniosis [26, 27, 28, 29] and common foodborne pathogens [30]. A study by [31] prioritized 43 zoonotic diseases and indicated them as major disease burdens and demanding due attention in order of their magnitude in the country. Consumer's knowledge on the risk posed by zoonotic diseases linked with consumption of animal products and the protective measures are crucial to design effective zoonotic diseases control and prevention strategy. However, in Ethiopia information on the public risk perceptions and protective measures of zoonotic diseases are limited. Therefore, the objective of the study was to assess the public risk perceptions and protective practices toward zoonotic diseases associated with the consumption of raw meat and milk.

2. Materials and methods

2.1. Study area

The study was conducted in Bishoftu Town and its surroundings from November 2017 to April 2018. Bishoftu is located in Oromia National Regional State, 47 km southeast of Addis Ababa. Its absolute location lays at 8°45′N latitude and 38°59′E longitude at an altitude of 1850 m above sea level in the central highlands of Ethiopia. The annual rainfall is 871mm of which 84% is in the long rainy season starting from June to September and the remaining come in the short rainy season extending from March to May. The mean annual maximum and minimum temperatures of the area are 26 °C and 14 °C, respectively with an average relative humidity of 63.8% [32]. Bishoftu is the capital of Ada'a district. According to population projection estimates in 2017, the district has an estimated human population of 327,083 of which 161,354 and 165,729 were urban and rural residents, respectively [33].

2.2. Study design and theoretical framework

The study employed a cross-sectional study design guided by food safety health belief model (FSBM) which is an adapted form of health belief model to generate the desired data. The model has been used to explain a wide variety of health behaviors associated with food safety [34]. According to the food safety health belief model and the generic health belief model, perceived susceptibility to health hazards like zoonotic diseases and perceived benefits and barriers to protective health behaviors are the key constructs to measure individuals' attitudes regarding health behavior. In the present study, we assessed the difference in the risk perception and protective behaviors of urban and peri-urban dwellers associated with the risky behavior, consumption of either raw meat or raw milk against the socio-demographic characteristics and the FSBM constructs (perceived susceptibility, protective behaviors, perceived barriers, and perceived benefits).

2.3. Sample size and sampling

The required sample size was determined using the recommended formula by Arsham (2002) (i.e. $N = 0.25/SE^2$, where: N is sample size, SE is standard error = 5%) for conducting questionnaire survey. Accordingly, the minimum expected sample size was 100 and we collected the desired information data from 105 individuals from each site (urban and peri-urban) for making valid comparison of the risk perception and protective behaviors. The participants were selected conveniently based on their willingness to participate in the study.

2.4. Data collection and eligibility

Pretested and structured questionnaire was used as a data collection tool. The data were collected through face-to-face interview by the first author of the study. The questionnaire was categorized into 1) socio-demographic characteristics of the respondents, 2) knowledge on food-borne diseases and the risk of consumption of raw meat and milk and 3) items describing the major constructs of food safety belief model: perceived susceptibility, perceived protective behaviors, perceived barriers and perceived benefits. For the items in the food safety belief model constructs, participants were asked to indicate their level of agreement to the given statements eliciting their own views on a three-point scale (strongly disagree, moderately agree and strongly agree). All adult respondents above 15 years old age were eligible for the study with the assumption that these individuals can practice the risky behavior of consuming raw meat and milk, which is not common among children. The two commonly spoken local languages, Afan Oromo and Amharic, in the area were used for the interview. The data were collected after explaining the objectives of the study and obtaining a verbal consent of the participants.

2.5. Ethical statements and approval

This study was conducted after the procedures were reviewed and approved by the Institutional Health Research Ethics Review Committee (IHRERC) of College of Health and Medical Sciences, Haramaya University (Ref. No. IHRERC/119/2017). The aim of the study and its future impacts in zoonotic disease control and prevention were clarified in detail to the study participants and the required data were collected after obtaining oral consent from all participants.

2.6. Data management and analysis

The collected data was entered into Microsoft spreadsheet and analyzed using STATA version 14 software. Descriptive statistics such as frequencies and percentages were used to summarize the results. Binary logistic regression was used to assess the association of socio-demographic characteristics of the respondents with the dependent

variables, the risky behaviors of consumption of raw meat and/or milk. Ordinal logistic regression was applied to assess the associations of urbanity with the food safety constructs (perceived susceptibility, perceived severity, perceived benefits of protective behaviors and barriers) response outcomes (strongly disagree, moderately agree and strongly agree). The *p*-value less than 0.05 was set as significance level.

3. Results

3.1. Socio-demographic characteristics

All the study participants responded to the face to face interview questions. Among the respondents, 91% and 94.3% had raw meat and raw milk consumption habits, respectively having the risky behaviors that potentially expose them to zoonotic diseases. Of the socio-demographic characteristics, only sex was found to be significantly associated with the risky behavior of consuming raw meat where the odds of raw meat consumption was about four times in males as compared to females (AOR = 3.90; CI = 1.28–11.86) (Table 1). Contrary to this, relatively more females (97.85%) had habit of raw milk consumption, although the result was not statistically significant (Table 2).

3.2. Knowledge of meat and milk borne zoonotic diseases

The majority (96.2%) of respondents had knowledge about zoonotic diseases that can be transmitted through consumption of raw meat and milk. Nearly half of the respondents (46.7%) reported that community members including, friends and neighbors are the primary sources of information about zoonotic diseases. Of the respondents, about 65% of them had practice of backyard slaughtering of food animals including "*kircha*", traditional slaughtering and sharing of meat among community groups without routine meat inspection. This practice was more common among the peri-urban dwellers. Self-owned dairy farms and smallholder dairy farms are the major sources of milk for peri urban and urban dwellers, respectively (Table 3).

3.3. Perceived susceptibility

Among the respondents, a little over half (50.95%) of them moderately agreed that consumption of raw meat and raw milk expose them to risk of zoonotic diseases. There was statistically significant difference was observed between urban and peri-urban dwellers on their level of agreement whether consumption of raw or unsafe milk exposes them to zoonosis or not ($\beta = -0.752$; $P = 0.005$). By far, higher proportion (90.48%) of the urban dwellers agreed that consumption of raw milk can expose people to zoonotic diseases as compared to peri-urban dwellers (26.67%) of those had strongly disagreed on that consumption of raw milk is harmful to their health. The level of agreements of the respondents was not significantly differ between urban and peri-urban dwellers for the remaining three items describing the perceived susceptibility (Table 4).

3.4. Perceived protective behaviors

There was statistically significant difference was found between urban and peri-urban dwellers on their level of agreement on the perceived protective behaviors of avoiding eating raw meat ($\beta = -0.70$; $P = 0.02$) and milk ($\beta = -0.71$; $P = 0.04$), refrigerating meat and milk ($\beta = -3.69$; $P < 0.001$), and use of appropriate latrines ($\beta = -2.11$; $P < 0.001$) as ways of prevention or control of zoonotic diseases (Table 5).

3.5. Perceived barriers

The majority of the peri-urban residents had some barriers that enforce them not to consume safe meat or milk. For instances, 93.33% and 60.95% of the peri-urban dwellers strongly agreed that the perceived barriers were lack of access to refrigerators and pasteurized milk that prevent them from getting protection against zoonotic diseases linked with consumption of milk and meat. In contrast to this, they have no problems in cooking meat or boiling milk or they will get help from their nearby people when a need arises. There was a statistically significant differences between urban and peri-urban dwellers on the order of their level of agreement on perceived barriers of lack of access to pasteurized milk ($\beta = 4.9$; $P < 0.001$) and lack of refrigerator ($\beta = 4.49$; $P < 0.001$) for possible protection against zoonotic diseases (Table 6).

3.6. Perceived benefits

In all of the three items describing the perceived benefits of protective behaviors, there were statistically significant differences in the level of agreements of the respondents based on their residence ($P < 0.05$). Higher proportions of urban dwellers were strongly agreed that avoiding eating raw meat (77.14%) and drinking boiled or pasteurized milk (69.52%) can reduce risk of zoonotic diseases as compared to the peri-urban dwellers (Table 7).

4. Discussion

In the present study, the 96.2% respondents have knowledge about zoonotic diseases that was comparable with the findings of other studies

Table 1. Multivariable mixed-effect logistic regression analysis of socio-demographic characteristics of the respondents for raw meat consumption.

Variables		Number of respondents	Consume raw meat (n = 191)	Multivariable (AOR)	95% CI	P-value
Sex	Female	93	84.95	Ref		
	Male	117	95.73	3.896	1.280–11.857	0.017
Age	15–18	31	93.55	Ref		
	18–50	120	90	0.862	0.141–5.276	0.873
	>50	59	91.53	2.404	0.258–22.432	0.441
Residence	Peri-urban	105	89.52	Ref		
	Urban	105	92.38	1.327	0.435–4.047	0.619
Education	Illiterate	41	87.8	Ref		
	Primary	70	90	1.262	0.292–5.463	0.756
	Secondary	62	93.55	2.241	0.417–12.046	0.347
	Tertiary	37	91.89	1.180	0.179–7.764	0.863
Marital Status	Divorced	4	100	Ref		
	Widowed	4	75	1	–	–
	Married	98	87.76	2.942	0.226–38.243	0.410
	Single	104	94.23	6.496	0.370–114.0	0.201

Table 2. Multivariable mixed-effect logistic regression analysis of socio-demographic characteristics of the respondents for raw milk consumption.

Variables		Number of respondents	Consume raw milk (n = 198)	Multivariable (AOR)	95% CI	P-value
Sex	Male	117	91.45	Ref		
	Female	93	97.85	3.819	0.782–18.651	0.098
Age	15–18	31	93.55	Ref		
	18–50	120	92.5	0.970	0.167–5.646	0.973
	>50	59	98.31	3.017	0.164–55.584	0.458
Residence	Peri-urban	105	94.29	Ref		
	Urban	105	94.29	1.273	0.331–4.902	0.726
Education	Tertiary	37	91.89	Ref		
	Secondary	62	93.55	1.337	0.234–7.642	0.744
	Primary	70	94.29	1.420	0.226–8.936	0.709
	Illiterate	41	97.56	1.994	0.137–29.118	0.614
Marital Status	Single	104	92.31	Ref		
	Married	98	95.92	1.036	0.226–4.762	0.963
	Divorced	4	100	1	–	–
	Widowed	4	100	1	–	–

Table 3. Sources of meat and milk and primary source of information on zoonoses of the respondents in Bishoftu.

Variables		Residence		
		Urban (n = 105) (%)	Peri-urban (n = 105) (%)	Total (%)
Sources of meat	Backyard slaughter	53 (50.5)	83 (79.0)	136 (64.8)
	Butcher shops and hotels	52 (49.5)	22 (21.0)	74 (35.2)
Sources of milk	Self-owned dairy farm	15 (14.3)	97 (92.4)	112 (53.3)
	Supermarkets and hotels	37 (35.2)	2 (1.9)	39 (18.6)
	Smallholder dairy farms	51 (48.6)	6 (5.7)	57 (27.1)
	Don't drink milk at all	2 (1.9)	0 (0.0)	2 (1.0)
Primary sources of information	Media such as TV and Radio	3 (2.9)	10 (9.5)	13 (6.2)
	School via students	51 (48.6)	29 (27.6)	80 (38.1)
	Human health care centers	4 (3.8)	2 (1.9)	6 (2.9)
	Community	38 (36.2)	60 (57.1)	98 (46.7)
	Animal health professionals (veterinarians and other animal health workers)	3 (2.9)	2 (1.9)	5 (2.4)
	No information at all	6 (5.7)	2 (1.9)	8 (3.8)

Table 4. Ordinal logistic regression analysis of items describing respondent's perceived susceptibility to zoonotic diseases (n = 210) in Bishoftu.

Variables	Strongly disagree (%)	Moderately agree (%)	Strongly agree (%)	β value	*p*-value
Do you think consumption of raw or undercooked meat exposes to zoonoses?					
Urban (105)	2.86	54.29	42.86	Ref	
Peri-urban (105)	6.67	47.62	45.71	0.023	0.932
Do you think consumption of raw or unpasteurized milk exposes to zoonoses?					
Urban (105)	9.52	54.29	36.19	Ref	
Peri-urban (105)	26.67	47.62	25.71	−0.752	0.005
Do you think improper handling of meat and milk expose to risk?					
Urban (105)	1.90	15.24	82.86	Ref	
Peri-urban (105)	0.95	9.52	89.52	0.572	0.163
Is it serious for someone to get diseased after consuming raw animal products?					
Urban (105)	9.52	55.24	35.24	Ref	
Peri-urban (105)	7.62	67.62	24.76	−0.335	0.230

in the country that reported all (100%) and 91.2% of respondents in Addis Ababa [35] and in Asella [36], respectively had information on zoonotic diseases. We noted that nearly half (46.7%) of the respondents relay on community as their own primary source of information about zoonotic disease(s) and this finding was in agreement with previous study by Amenu et al. [37]. This study underlines the low participation of animal health professionals in promotion of public health parallel to provision of veterinary services. Only 2.4% of respondents reported veterinarians and other animal health professionals as sources of information about zoonoses. This finding is comparable with study in Addis Ababa, which reported about 9% of respondent got information from animal health professionals [38].

The observed proportion of raw meat consumers (91% of respondents) was higher than other studies in Ethiopia that reported 62% in Harar town [27], 68.5% in and around Dodola Town [39] and 77% in Asella town [36], but the consumption of raw milk (94.3% of

Table 5. Ordinal logistic regression analysis of items describing respondent's protective behaviors of zoonotic diseases associated with consumption of meat and milk in Bishoftu (n = 210).

Variables	Strongly disagree (%)	Moderately agree (%)	Strongly agree (%)	β value	*p*-value
I intend not to eat raw meat					
Urban (105)	58.1	27.62	14.29	Ref	
Peri-urban (105)	75.24	13.33	11.43	−0.702	0.017
I intend not to drink raw milk					
Urban (105)	73.33	19.05	7.62	Ref	
Peri-urban (105)	84.76	11.43	3.81	−0.706	0.043
I refrigerate meat and milk					
Urban (105)	22.86	58.1	19.05	Ref	
Peri-urban (105)	93.33	2.86	3.81	−3.692	<0.001
I always thoroughly inspect meat for presence of gross abnormality or contamination					
Urban (105)	22.86	70.48	6.67	Ref	
Peri-urban (105)	18.1	69.52	12.38	0.414	0.168
I eat cooked meat instead of raw meat					
Urban (105)	11.43	78.10	10.48	Ref	
Peri-urban (105)	7.62	80.0	12.38	0.305	0.368
I drink boiled/pasteurized milk					
Urban (105)	15.24	79.05	5.71	Ref	
Peri-urban (105)	8.57	87.62	3.81	0.336	0.367
I always regularly take my hygienic measures					
Urban (105)	0	3.81	96.19	Ref	
Peri-urban (105)	0	2.86	97.14	0.298	0.702
I always use toilet or latrines					
Urban (105)	0	20.95	79.05	Ref	
Peri-urban (105)	9.52	58.1	32.38	−2.113	<0.001
I seek medical health care service, the moment I perceived being infected or diseased after consuming raw meat or milk					
Urban (105)	5.71	41.9	52.38	Ref	
Peri-urban (105)	10.48	48.57	40.95	−0.489	0.069
I advise others to refrain from consuming animal products and to seek health care if something goes wrong after consuming raw meat or milk					
Urban (105)	66.67	27.62	5.71	Ref	
Peri-urban (105)	74.29	24.76	0.95	−0.418	0.167

Table 6. Ordinal logistic regression analysis of items describing respondent's perceived barriers to use protective behaviors of zoonotic diseases in Bishoftu (n = 210).

Variables	Strongly disagree (%)	Moderately agree (%)	Strongly agree (%)	β value	*p*-value
I don't have facilities to cook meat or boil milk, if I want to do so					
Urban (105)	95.24	3.81	0.95	Ref	
Peri-urban (105)	99.05	0.95	0	−1.652	0.135
If I want pasteurized milk, access to it is rare					
Urban (105)	47.62	50.48	1.9	Ref	
Peri-urban (105)	0	39.05	60.95	4.855	<0.001
I have no refrigerator to refrigerate milk/meat					
Urban (105)	83.81	0.95	15.24	Ref	
Peri-urban (105)	3.81	2.86	93.33	4.489	<0.001
If I want to eat cooked meat or boiled milk, my religion, culture or families enforce me not to do so					
Urban (105)	96.19	3.81	0	Ref	
Peri-urban (105)	96.19	3.81	0	0.000	1.000
I have no enough knowledge of cooking meat or boiling milk and no one around to help me on doing so					
Urban (105)	89.52	8.57	1.9	Ref	
Peri-urban (105)	100	0	0	−17.347	0.992

respondents) was comparable with 87% in Asella town [36]. In Ethiopia, consumption of raw meat in the form of steak ("*kurt*") or beef tartare ("*kitfo*") made from raw or undercooked ground (minced) beef is a well-known and common practice across the country [12, 13]. This is considered a part of tradition and could be the main reason for respondents of this study to have experienced eating raw meat though they were aware of possible exposure to zoonotic diseases. Consumption of raw milk and its products are also common in most developing countries and in some developed countries with variable proportion [40]. The relatively high prevalence of bacterial pathogens observed in meat and its products in Ethiopia may possibly be considered as potential sources of human foodborne illnesses [30]. The differences in the proportion of raw meat and raw milk consumption in different areas or countries might be attributed to the difference in the level of awareness of the risk of zoonotic diseases and associated protective measures and access to safe food of animal origin such as pasteurized milk.

None of the sociodemographic factors except sex were statistically significantly associated with raw meat consumption and the authors believe that this could be due to the tradition of raw animal product consumption in the country where commonly males have access to raw meat consumption such as during traditional meat slaughtering and sharing; whereas women are more engaged in milking and milk processing [13, 41, 42]. This study revealed that both are at higher risk of acquiring zoonotic diseases regardless of the type of animal products.

People in the study area are at a high risk to meat and milk borne diseases given their habit of raw and uninspected meat and raw milk consumption as it was evident in the present study. The practice of obtaining meat from backyard-slaughtered animals without meat inspection procedure by trained meat inspector was in agreement with other studies [3, 27, 39]. The risky practice of backyard slaughtering could result in contamination of meat during slaughtering and processing with pathogenic organisms that eventually reach humans through consumption in raw and undercooked form. Similarly, higher proportion (80.5%) of respondents were getting milk from self-owned dairy farms or from smallholder dairy farms which usually produces milk under poor hygienic conditions and marketing of the milk is practiced in informal market without strict quality control [16, 43].

The respondents perceived protective behaviors were very low given their habit of consuming raw milk and meat despite their knowledge of transmission of zoonotic diseases via consumption of raw or undercooked animal products. Surprisingly, most of the respondents do not intend to

Table 7. Ordinal logistic regression analysis of items describing respondent's perceived benefits of protective behaviors toward zoonotic diseases in Bishoftu (n = 210).

Variables	Strongly disagree (%)	Moderately agree (%)	Strongly agree (%)	β value	*p*-value
If I don't eat raw meat, I could reduce the chance of getting meat borne disease					
Urban (105)	0.95	21.9	77.14	Ref	
Peri-urban (105)	1.9	39.05	59.05	−0.848	0.005
If I don't drink raw milk, I could reduce the chance of getting milk borne disease					
Urban (105)	5.71	24.76	69.52	Ref	
Peri-urban (105)	9.52	43.81	46.67	−0.915	0.001
If I consume cooked meat or boiled milk, I will not be exposed to disease associated with raw meat/milk consumption, and unnecessary medical costs					
Urban (105)	0	16.19	93.81	Ref	
Peri-urban (105)	1.9	30.48	67.62	−0.922	0.006

stop the consumption of raw meat and milk suggesting that meat and milk borne diseases will continue to be major problems in the area unless designing intervention measures that give due attention to this risky practice. Previous studies in different areas of Ethiopia [27, 44, 45, 46] indicated common practice of consumption of raw meat and raw milk even though they were aware of the risk of consuming raw animal products while knowing the risk of zoonotic diseases. Consumption behavior of raw food of animal origin complexed with problems related to contamination of milk and meat, inadequate supply of health care facilities, and socioeconomic and cultural practices can be the main factors that expose the public to different zoonotic diseases [27, 41].

This study highlighted the presence of certain barriers that may increase the likelihood of acquiring foodborne pathogens in the study area. For peri-urban respondents, lack of access to pasteurized milk and cooling facilities were the two main barriers to milk and meat safety. Similar to this study, a study by [47] indicated that lack of access to pasteurized milk as the perceived barriers for protection against milk borne diseases. Compared to the peri urban residents, a higher proportion of urban dwellers strongly agreed that avoiding eating raw meat (77.14%) and drinking boiled or pasteurized milk (69.52%) reduce risk of zoonotic diseases. Use of toilet is common among urban residents whereas some peri-urban dwellers neither use toilet nor dry pit latrines. A report by Alemu et al. [48] have shown a lack of appropriate sanitation technology and limited access to these facilities in the rural communities due to a wide range of socioeconomic factors.

5. Conclusions

Despite the majority of the respondents had knowledge about zoonoses and the potential risk of consuming raw meat and milk, consumption of animal products and the practice of backyard slaughtering will remain deep-rooted cultural practices in the study area. Furthermore, it was also noted that the participation of animal health professionals in educating the community about the magnitude of threats of zoonotic diseases was not sufficient. Therefore, public health education regarding the risk of consumption of raw milk and meat and on the significance of protective behaviors need to be designed through the application of one health concept that promotes the collaborative effort among the stakeholders in this case involving public health and animal health sector which need to work together to ensure milk and meat safety.

Declarations

Author contribution statement

Dagne Tsegaye: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data; Wrote the paper.

Fanta D. Gutema, Yitagele Terefe: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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