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Assessment of Community Awareness Towards Zoonotic Tuberculosis in West Shoa, Ethiopia

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Abstract: A questionnaire based cross-sectional study was conducted from October, 2015 to April, 2016 to assess awareness of the community towards the zoonotic importance of bovine tuberculosis in Bako town and its surrounding villages. About 480 randomly selected human populations were interviewed. Awareness of respondents about zoonotic importance of bovine tuberculosis has significantly different in different categories of the variables including educational level (p=0.001), occupation (p=0.007) and age (p=0.041) of the respondents. 58.1% (280) of population have a knowledge of zoonotic tuberculosis transmission through consumption of raw milk, whereas 7.9% (38), 4.4% (21) and 9.2% (44) aware only zoonotictuberculosis transmission through uncooked meat, inhalation and contact, respectively. However, 20.2% (97) of respondents were having no awarenesson the transmission routes of zoonotic TB. From the respondents, 63 (13.1%) were consume raw milk, even though most of the participants (170, 59%) were consuming boiled milk. Those consume both raw and boiled milk were accounted for 58 (20.1%). The ways of community milk usage was significantly different in different types of respondent's occupation and in different districts (p=0.000). This study indicates that the community awareness about zoonotic tuberculosis and its means of transmission was very low. Therefore, it necessitates detail study on epidemiological and socioeconomic significance of the disease in the community so as for effective implementation of TB control and prevention measures.

Keywords: Bovine, Epidemiology, Cross Sectional, Tuberculosis, Transmission

1. Introduction

It is well known that humans and animals have had close interactions. The interaction is becoming largely increased in the 21st century due to the shift from extensive rural production system into the combined urban and peri-urban intensified livestock husbandry to satisfy the rise in demand for animal products. This largely contributes to the on-going transmission of shared infectious zoonotic diseases from cattle to humans [1]. Bovine tuberculosis among the principal zoonotic diseases is caused by *Mycobacteriumbovis*, member of the Mycobacterium tuberculosis complex (MTC), which affects many vertebrate animals and humans [2, 3, 4].

Tuberculosis (TB) caused by bovine origin has emerged as a significant disease with the tendency for inter-species spread. Bovine tuberculosis has been significantly widely distributed throughout the world and has been a cause for great economic loss in animal production and the most frequent cause of zoonotic TB in man [5]. In developed countries, mandatory pasteurization of milk combined with tuberculin testing and culling (slaughter) of infected cattle resulted in dramatic decline in the incidence of human TBdue to *Mycobacterium bovis* (*M. bovis*) [6]. In Africa; however, BTB represents a potential health hazard to both animals and humans, as nearly 85% of cattle and 82% of the human population live in areas where the disease is prevalent or only partially controlled. In developing countries where BTB is still common and pasteurization of milk is not practiced, an estimated 10 to 15% of human TBcases are caused by *M. bovis* [7].

In Ethiopia, BTB is considered to be prevalent disease in cattle populations. Tuberculin skin test survey indicates that the prevalence ranges from 0.8% in extensive rural farming systems that keep Zebu cattle to 50% in intensive husbandry systems [8, 9]. Many studies have shown that there are many risk factors conducive to the spreading and persistence of BTB in developing countries such as demography, eating habits, living and socio-economic status of families, illiteracy, culture and customs, the existence of HIV/AIDS, and closeproximity with animals [10, 11]. Ethiopian milkconsumers generally prefer raw milk (as compared totreated milk) because of its taste, availability and lowerprice.

The effective control and eradication of BTB from herds and/or farms of cattle depend on identifying and isolating potential sources of infection from the herds, through test-and-slaughter-strategy. However, there are also various modifications of eradication and control programmes adopted in different countries. In developed countries BTB has nearly been eradicated or drastically reduced in farm animals to low levels by control and eradication programmes [10, 12, 13,]. In Ethiopia these measures, however, cannot be adopted in practice due to various reasons such as: lack of knowledge on the actual prevalence of the disease, the prevailing technical and financial limitations, lack of veterinary infrastructures, cultural and/or traditional beliefs and geographical barriers, though certain control measures are in place. Therefore, the objective of this study was to assess the awareness about the zoonotic tuberculosis in the targeted population.

2. Materials and Methodology

2.1. Description of Study Area and Study Population

The study was conducted in and around Bakocity from October 2015 to April 2016. Bako town is the center of BakoTibe district in Oromia National Regional State of Ethiopia. The town is located 250 km in the west of Addis Ababa, the capital city of Ethiopia, at an altitude of 1650 m above sea level on 37° 09' E and 9° 06' N. The town has hot and humid climate with average relative humidity of 60%. Thestudy wasconductedin human population of Bako town and its surrounding villages. The target populations are consisting of farmers, students, civil servants, merchants and others.

2.2. Study Design, Sampling Methods and Study Methodology

A questionnaire based cross-sectional study design was conductedto know the perception of the human population regarding the zoonotic bovine tuberculosis. The study was conducted in both urban and rural areas of BakoTibe district. Peasant association is the lowest administrative unit within the district that was considered during the study. Accordingly, three peasant association (one urban and two rural) were randomly selected from the district.

A simple random sampling method was employed to select the respondents. As a result, therespondents were selected randomlywithout any criteria during questionnaire administration in different areas of Bako and in itsrandomly selected surrounding villages. A semi structured questionnaire which covered socio-demographic characteristics, knowledge and awareness of target population about zoonotic tuberculosis was used to collect data. The purpose of the study as well as methodology was explained to respondents and their oral consent was obtained before enrolment of their name in the study. Local language, which is Afan Oromo, was used for the interview and on an average 15 to 25 minutes was spent with each respondent. Accordingly the semi structured questionnaire supplemented with interview was administered to 480 people; among whom 79 students, 296 farmers, 55 civil servants, 49 merchants and 1 other body, were included in the study.

2.3. Data Analysis

The collected raw data was coded and entered into Microsoft Excel spread sheetprogram. The Statistical Package for Social Science (SPSS) version 20 software was used for descriptive analysis and Pearson Chi-Square test to evaluate the significance of association in category of the variables at confidence level of 95%. Sex, age, marital status, educational status, occupation and districts of the respondentswere considered as the variables.

3. Results

In this study, the socio-demographic characteristics of the respondents were analyzed. From all 480 respondents thenumbers of males wereaccounted 60% (288) and that of females is 40% (192). The highest numbers of respondents were in age group of 18 to 30 years. Regarding the marital status of targeted population 82.7% (397) of them were married whereas 17.3% (83) were not married. Among the total number 480 of respondents, 148 (30.8%) were have awareness about zoonotic TB. From these respondents males (31.9%, 92) have more awareness than females (29.2%, 56). The awareness of respondents about zoonotic importance of bovine tuberculosis has significant difference in different categories of the variables including educational level (p=0.001), main occupation (p=0.007), district (p=0.009) and age (p=0.041) (table 1).

Table 1. *Community awareness of zoonotic TB in different socio-demographic variables.*

Variables	Category	Interviewed number	Awareness N^o (yes)	Percentage	X^2	P-value
	Male	288	92	31.9		
Sex	Female	192	56	29.2	0.42	0.52
	Total	480	148	30.8		

Variables	Category	Interviewed number	Awareness Nº (yes)	Percentage	X^2	P-value
Age	18-30	172	59	34.3	6.4	0.041
	31-50	149	52	34.9		
	>50	159	37	23.3		
	Total	480	148	30.8		
Marital status	Single	83	30	36.1	1.33	0.25
	Married	397	118	29.6		
	Total	480	148	30.8		
Level of education	Illiterate	115	21	18.3	11.21	0.001
	Literate	365	127	34.8		
	Total	480	148	30.8		
District	02	160	64	40	9.46	0.009
	DambiGobu	160	42	26.2		
	DambiDima	160	42	26.2		
	Total	480	148	30.8		
Occupation	Student	79	26	32.9	14.22	0.007
	Farmer	296	76	25.7		
	Civil servant	55	22	40		
	Merchant	49	23	46.9		
	Other	1	1	0.3		
	Total	480	148	30.8		

3.1. Awareness of Ways of TB Transmission

The awareness of transmission of bovine TB routes was also assessed in human population in the study area. Among the total participants, 58.1% (280) of them have knowledge of TB transmission through consumption of raw milk. Whereas 7.9% (38), 4.4% (21) and 9.2% (44) have knowledge of TB transmission through uncooked meat, inhalation and contact, respectively. However, 20.2% (97) of respondents werehaving no knowledge on the transmission routes of zoonotic TB (Table 2).

Table 2. *Knowledge of community about different ways of zoonotic TB transmission in different variables.*

Variables	Category	Transmission ways (in number and Percentage)						X^2	P-value
		Milk	Meat	Inhalation	Contact	No idea	Total		
Sex	Male	171(59.4%)	22(7.6%)	13(4.5%)	20(6.9%)	62(21.5%)	288(100%)	4.7	0.32
	Female	109(56.8%)	16(8.3%)	8(4.2%)	24(12.5%)	35(18.2%)	192(100%)		
	Total	280(58.1%)	38(7.9%)	21(4.4%	44(9.2%)	97(20.2%)	480(100%)		
Age	18-30	109(63.4%)	15(8.7%)	7(4.1%)	11(6.4%)	30(17.4%)	172(100%)	8.9	0.35
	31-50	83(55.7%)	14(9.4%)	9(6%)	15(10.1%)	28(18.8%)	149(100%)		
	>50	88(55.3%)	9(5.7%)	5(3.1%)	18(11.3%)	39(24.5%)	159(100%)		
	Total	280(58.3%)	38(7.9%)	21(4.4%	44(9.2%)	97(20.2%)	480(100%)		
Marital status	Single	50(60.2%)	11(13.3%	6(7.2%)	3(3.6%)	13(15.7%)	83(100%)	9.9	0.04
	Married	230(57.9%)	27(6.8%)	15(3.8%	41(10.3%)	84(21.2%)	397(100%)		
	Total	280(58.3%)	38(7.9%)	21(4.4%	44(9.2%)	97(20.2%)	480(100%)		
Level ofeducation	Illiterate	57(49.6%)	5(4.3%)	6(5.2%)	16(13.9%)	31(27%)	115(100%)	11	0.02
	Literate	223(61.1%)	33(9%)	15(4.1%	28(7.7%)	66(18.1%)	365(100%)		
	Total	280(58.3%)	38(7.9%)	21(4.4%	44(9.2%)	97(20.2%)	480(100%)		
District	02	116(72.5%)	6(3.8%)	3(1.9%)	6(3.8%)	29(32.3%)	160(100%)	31.4	0.0
	D. Gobu	81(50.6%)	13(8.1%)	13(8.1%	20(12.5%)	33(20.6%)	160(100%)		
	D. Dima	83(51.9%)	19(11%)	5(3.1%)	18(11.2%)	35(21.9%)	160(100%)		
	Total	280(58.3%)	38(7.9%)	21(4.4%	44(9.2%)	97(20.2%)	480(100%)		
Occupation	Student	45(57%)	11(13.9%	5(6.3%)	4(5.1%)	14(17.7%)	79(100%)	48.9	0.00
	Farmer	151(51%)	25(8.4%)	16(5.4%)	37(12.5%)	67(22.6%)	296(100%)		
	Civil servant	50(90.9%)	2(3.6%)	-	1(1.8%)	2(3.6%)	55(100%)		
	Merchant	33(67.3%)	-	-	2(4.1%)	14(28.6%)	49(100%)		
	Other	1(100%)	-	-	-	-	1(100%)		
	Total	280(58.3%)	38(7.9%)	21(4.4%)	44(9.2%)	97(20.2%)	480(100%)		

3.2. Milk Usage

The community of the study area were consuming milk in different ways. 13.1% (63) of the study population were consuming raw (untreated) milk, whereas 59% (170) were consuming boiled (treated) milk. Those consume both raw and boiled milk was accounted for 20.1% (58). (However, some of the respondents 7.3% (21) were totally not consuming milk. The ways of community milk usage was significantly different in different occupation of respondents (p=0.000) and in different districts (table 3).

Table 3. *The ways of milk usage within the community with respect to different variables.*

Factors with their respective X^2 and P-value		Ways of milk usage within the community				
		Raw milk No (%)	**Boiled No (%)**	**Both raw and boiled No (%)**	**Never No (%)**	**Total No (%)**
Sex	Male	39(13.5%)	170(59%)	58(20.1%)	21(7.3%)	288(100%)
	Female	24(12.5%)	111(57.8%)	38(19.8%)	19(9.9%)	192(100%)
	Total	63(13.1%)	281(58.5%)	96(20%)	40(8.3%)	480(100%)
	X^2	1.07				
	P-value	0.785				
Age	18- 30	19(11%)	108(62.8%)	30(17.4%)	15(8.7%)	172(100%)
	31-50	21(14.1%)	83(55.7%)	34(22.8%)	11(7.4%)	149(100%)
	>50	23(14.5%)	90(56.6%)	32(20.1%)	14(8.8%)	159(100%)
	Total	63(13.1%)	281(58.5%)	96(20%)	40(8.3%)	480(100%)
	X^2	3.12				
	P-value	0.794				
Marital status	Single	9(10.8%)	51(61.4%)	17(20.5%)	6(7.2%)	83(100%)
	Married	54(13.6%)	230(57.9%)	79(19.9%)	34(8.6%)	397(100%)
	Total	63(13.1%)	281(58.5%)	96(20.3%)	40(8.3%)	480(100%)
	X^2	0.701				
	P-value	0.873				
Level of education	Illiterate	22(19.1%)	58(50.4%)	25(21.7%)	10(8.7%)	115(100%)
	Literate	41(11.2%)	223(61.1%)	71(19.5%)	30(8.2%)	365(100%)
	Total	63(13.1%)	281(58.5%)	96(20%)	40(8.3%)	480(100%)
	X^2	6.12				
	P-value	0.107				
District	02	9(5.6%)	115(71.9%)	24(15%)	12(7.5%)	160(100%)
	D. Gobu	28(17.5%)	79(49.4%)	36(22.5%)	17(10.6%)	160(100%)
	D. Dima	26(16.2%)	87(54.4%)	36(22.5%)	11(6.9%)	160(100%)
	Total	63(13.1%)	281(58.5%)	96(20%)	40(8.3%)	480(100%)
	X^2	22.6				
	P-value	0.001				
occupation	Student	8(10.1%)	46(58.2%)	17(21.5%)	8(10.1%)	79(100%)
	Farmer	52(17.6%)	152(51.4%)	66(22.3%)	26(8.8%)	296(100%)
	Civil. Serv	-	49(89.1%)	6(10.9%)	-	55(100%)
	Merchant	3(6.1%)	33(67.3%)	7(14.3%)	6(12.2%)	49(100%)
	Other	-	1(100%)	-	-	1(100%)
	Total	63(13.1%)	281(58.5%)	96(20%)	40(8.3%)	480(100%)
	X^2	36.6				
	P- Value	0.000				

4. Discussion

Naturally, the occurrence of zoonotic TB is greatly dependent on the presence of TB in cattle. Knowing the awareness and perception of the community regarding the zoonotic transmission of bovine tuberculosis is very important. So that the control and prevention measures of the zoonotic TB can be undertaken. In the present study, 58.1% of respondents have awareness about bovine TB; however only 30.8% of them had awareness on bovine TB as it is zoonotic. This report disagrees with report from Cameroon, which indicated 81.9% of cattle handlers know bovine TB, and 67.9% of them aware as bovine TB is zoonotic [14]. Study in in Shinile town, Somali regional state, eastern Ethiopia also indicates that majority (94.9%) of the respondents had, at the very least, heard of TB disease[15]. In contrast study in Itang District, Gambella Region, South

Western Ethiopia indicates most of the respondents (94.3%) have heard about TB, while only 13.9% had heard of animal TB [16]. Similarly TB awareness was recognized by 99.5% of students in Addis Ababa, Ethiopia [17]. It has been indicated that lack of understanding regarding the zoonotic of BTB, food consumption behavior and poor sanitary measures is the potential risk of BTB to public health [18].

However, assessment of the knowledge and awareness of cattle owners about bovine TB in Wuchale Jida district, Ethiopia showed that 38.3% (36 of 94) of the respondents knew that cattle can have tuberculosis, and 30.8% (29 of 94) recognized that bovine TB is zoonotic [18]. This report slightly agrees with the present study. The study conducted in Adama, central Ethiopia, shown that 35% of the interviewee understood that cattle could have tuberculosis from which only 32% also knew that bovine TB could be transmitted from cattle to humans [19] which is agrees with the current result. Even if there is a little difference in the awareness of the human populations, the study conducted in Dilla town, Southern Ethiopia that indicates the level of awareness of cattle ownersabout bovine TB wasabout 29.7% and those people that recognized bovine TB as it is zoonotic was about 22.9% [20].

Humans acquire the infection primarily by ingesting the agent in raw milk and milk products, and secondly by inhaling it when there is close physical contact between the owner and their cattle, especially at night since in some cases they share shelters with their animals [21]. In Ethiopia milk consumers generally prefer raw milk because of its taste, availability and lower price [22]. Moreover, in Scotland it had been reported that the incidence of *M. bovis* infection in cattle herds has been increased since 2000 suggesting a similar rise in theincidence of *M. bovis*infection in humans [23]. This means the proportion of which bovine TB contributes to total tuberculosis cases in humans depends on the prevalence of the disease in cattle, consumer habits, socio-economic conditions, level of food hygiene [7] and medical prophylaxis measures in practice [24]. According to the result of this study, 13.1% consume unpasteurized or raw milk. Similarly, studies conducted in different parts of Ethiopia indicated the habits of raw milk consumption. Study in Addis Ababa, Ethiopia shows that 66.2% of the respondents used raw milk products [17]. The current result is highly lower than (85.7%) report from Jimma town Ethiopia [24]. The reported from Dilla town, Southern Ethiopia also showed more than 80% of the respondents were consuming raw milk [20]. In addition to these, study conducted in Wuchale Jida district indicated 52.1% (49 of 94) households' has habit of consuming raw milk [18], which is also higher when compared with the current result. Keeping cattle and calves in close proximity to the owner house is a common practice of households in the study area. In this study the community awareness about zoonotic tuberculosis and its means of transmission were relatively low that necessitates detail study on epidemiological and socioeconomic significance of this disease.

5. Conclusion

This study indicates that most of the community have no awareness about the transmission of the tuberculosis disease from the animals to humans. At the same time those community that knows presence of zoonotic TB have no knowledge of ways/routes of TB transmission. That is why this study shows some of the respondents were using raw milk for consumption. Therefore awareness should be created on milk and its product usage for the community

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References

[1] Mbugiand EV, Katale BZ, Kendall S, Good L, Kibiki GS, Keyyu JD, Godfrey-Faussett P, Helden P, Matee MI (2012). Tuberculosis cross-species transmission in Tanzania towards a One-Health concept. J. Vet. Res. 79: 1-6.

[2] Buncic S (2006). Integrated Food Safety and Veterinary Public Health. 1st ed. CABI, London, UK. Pp 61.

[3] Amanfu W (2006). The situation of tuberculosis and tuberculosis control in animals of economic interest. Tub. J. 86: 330-335.

[4] OIE (2010). Bovine tuberculosis in Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. World Organization for Animal Health, Pp 683-698.

[5] Tenguria KR, Khan FN, Quereshi S, Pandey A (2011). Review Article Epidemiological Study of Zoonotic Tuberculosis Complex (ZTBC). Wor J ScTec. 1: 31-56.

[6] Palmer MV, Thacker TC, Waters WR, Gort CA, Corner LA (2012). Mycobacterium bovis a Model Pathogen at the Interface of Livestock, Wildlife, and Humans. Vet MedInt 1: 17.

[7] Ashford DA, Whitney E, Raghunathan P, Cosivi O (2001). Epidemiology of selected mycobacterium that infects humans and other animals. Rev ScTec Off Int Epiz. 20: 105-112.

[8] Regassa A, Medhin G, Ameni G (2008). Bovine tuberculosis is more prevalent in cattle owned by farmers with active tuberculosis in central Ethiopia. *Vet J.* 178: 119-125.

[9] Firdessa R, Tschopp R, Wubete A, Sombo M, Hailu E. (2012). High Prevalence of Bovine Tuberculosis in Dairy Cattle in Central Ethiopia: Implications for the Dairy Industry and Public Health. PLo SONE. **7**: 52851.

[10] Ayele WY, Neill SD, Zinsstag J, Weiss MG and Pavlik I (2004). Bovine tuberculosis, an old disease but a new threat to Africa. IntJ Tub. 8: 924-937.

[11] Girmay G, Pal M, Deneke Y, Weldesilasse G, Equar Y. (2012). Prevalence and public health importance of bovine tuberculosis in and around Mekelle town, Ethiopia. Int. J. Liv. Res. 2: 180-188.

[12] Cosivi O, Grange JM, Dabron CJ, Raviglione MC, Fujikura T, Cousins D, Robinson RA, Huchzermeyer HF, de Kantor I, Meslin FX (1998). Zoonotic tuberculosis due to *Mycobacterium bovis* in developing countries. EmeInfeDis vol. 4: 1-17.

[13] Pavlik I, Ayele WY, Parmova I, Melicharek I, Hanz- likova M, Kormendy B, Nagy G, Cvetnic Z, Ocepek M, Fejzic N, Lipiec M (2002). Incidence of bovine tuberculosis in cattle in seven Central European countries during the years. Vet. Med. 47: 45-51.

[14] Ndukum JA, Kudi AC, Bradley G, Ane-Anyangwe IN, Fon-Tebug S, Tchoumboue J (2010). Prevalence of Bovine Tuberculosis in Abattoirs of the Littoral and Western Highland Regions of Cameroon: A Cause for Public Health Concern. Veterinary Medicine International.

[15] Tolasa D, Girmay M and Mengistu L (2014). Community knowledge, attitude, and practices towards tuberculosis in Shinile town, Somali regional state, eastern Ethiopia: a cross-sectional study. BMC. Pub. H. 14: 804.

[16] Jango B, Mengistu L and Girmay M (2013). Community's knowledge, attitudes and practices about tuberculosis in Itang Special District, Gambella Region, South Western Ethiopia. BMC. Pub. H. 13: 734.

[17] Abraham HK, Dessalegn S, MA, Pal M (2014). Knowledge, Attitude and Practice towards Human and Bovine Tuberculosis among High School Students in Addis Ababa, Ethiopia. Int. J. Liv. Res. 5: 42-57.

[18] Ameni G, Amenu K, Tibbo M. (2003). Bovine tuberculosis: Prevalence and risk factor assessment in cattle and cattle owners in Wuchale-Jida district, Central Ethiopia. *Inte. J. Ap.* Res. Vet. Med. 1: 1-13.

[19] Ameni G. and Erkihun A (2007). Bovine tuberculosis and farmers' awareness in small-scale dairy farms in Adama Town. Rev. Sci. Tech. O. Inte. Ep. 26: 711-719.

[20] Gebremedhin R, Gebremedhin G, Gobena A (2014). Assessment of Bovine Tuberculosis and Its Risk Factors in Cattle and Humans at and around Dilla Town, Southern Ethiopia. Ani Vet Sci Vol 2: 94-100.

[21] Andersen P (1997). A review on host responses and antigens involved in protective immunity to Mycobacterium tuberculosis. Scan JIm. 45: 115-131.

[22] SNV (2008). Dairy Investment Opportunities in Ethiopia, Addis Ababa: The Netherlands Development Organization, Pp. 1-48.

[23] Stewart WC, Champion J, McMenamin J, Young D, Browning LM, Johnston F, Reilly WJ (2005). Twenty years of Mycobacterium bovis infection in people and cattle in Scotland.

[24] Tigre W, Alemayehu G, Abetu T, Deressa B. (2011). Preliminary Study on Public Health Implication of Bovine Tuberculosis in Jimma Town, South Western Ethiopia. *Global. Vet*. 6: 369-373.