Knowledge, Attitude and Practice towards Human and Bovine Tuberculosis among High School Students in Addis Ababa, Ethiopia

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Abstract

Tuberculosis (TB) is among the top public health threats globally. Zoonotic tuberculosis due to Mycobacterium bovis is common among developing countries. Due to the endemic immunosuppressive disease, existence of huge livestock population paralleled with marginal awareness, risky practice and lack of control strategy, bovine tuberculosis (BTB) has remained a public health concern among poor countries. Health education targeting children can serve to shape their perception and also potentially educating parents and breaking misperceptions about the disease. The objective of this study was to assess the knowledge, attitude and practice of high school students towards BTB in comparison to human TB in Addis Ababa, Ethiopia. A cross sectional study was conducted between November 2013 to December 2013 at public secondary schools. A structured questionnaire was designed, pretested and self-administered to ninth and tenth grade students in a local language. A total of 409 students (41.3% male and 58.7% female) were participated. Almost all (99.5%) had heard of human TB; however, only 57 (13.9%) knew BTB ($\chi^2 = 613.9$, $P=0.0001$). Information on human and animal TB was obtained mainly from radio/TV (81.3%) and (75.4%), respectively. Knowledge on the infectious cause of human and animal TB was known by 77.1% and 54.4%, respectively. However, misperception such as cold weather, locally termed as “Berd” was implicated as cause to human TB. Inhalation was the commonly reported route of transmission in human (93.7%) as well as in bovine (28%). Of all students, 89(21.7%) have experienced TB themselves or among persons they knew; however, no association (p>0.05) was seen with their knowledge on bovine 11/57(19.3%) and human TB 89/409 (21.7%).BTB is regarded as a public health significant disease 38 (66.7%). Only 27(47.3%) and 9 (15.8%) considered raw milk, and yogurt as vehicles to M. bovis infection, respectively. Overall, (66.2%) practiced use of pasteurized milk products.

The present study showed a much lower knowledge and awareness on bovine TB among students. Due to concerted educational effort on human TB, the student awareness has evolved when, ironically, on BTB is limited. Thus, the existing awareness intervention strategy should be operated along with animal TB under a One Health umbrella.

Key words: Attitude, High school students, Knowledge, Practice, Public health, Zoonotic tuberculosis
Introduction

Tuberculosis (TB) is among the top public health threats globally (WHO, 2014). Pulmonary tuberculosis occurs in 74 to 100% of patients with HIV (Pal, 2005). It is a potential disease of mammalian species including humans, and is caused by group of bacteria called Mycobacterium tuberculosis complex (Pal et al., 2014b). It signifies different species including Mycobacterium tuberculosis and Mycobacterium bovis (Thoen et al., 2009). M. tuberculosis (MTB) primarily causes TB in humans whereas M. bovis predominantly affects cattle causing bovine tuberculosis (Pal et al., 2014b). Bovine tuberculosis (BTB) is known to have a public health importance being transmitted from infected animals to humans through close contact and ingestion of raw animal products (Cosivi et al., 1998; Ashford et al., 2001; Pal, 2007; Pal et al., 2014b). Also, it represents financial burden due to loss of productivity to the livestock sector that can be explained through reduction of milk production and carcass condemnation (Acha and Szyfres, 2001; Girmay et al., 2012).

Globally, 3.1% of human cases are attributed due to M. bovis (Cosivi et al., 1998). Case numbers are low in developed countries because of efficient routine prevention steps like milk pasteurization and implementation of eradication program. Developing countries mainly suffer due to the high cases of HIV/AIDS, use of raw milk and poor living condition apart from lack of intervention system (Cosivi et al., 1998; Thoen et al., 2009). In endemic areas, where milk pasteurization is limited, it is estimated that about 10 to 15% human TB prevalence is due to M. bovis (Ashford et al., 2001). Ethiopia is one of the high burdened countries in the world with human TB cases predominately due to MTB (Pal et al., 2014b; WHO, 2014). Nonetheless, it remains an epicenter for potential zoonotic diseases such as BTB (Grace et al., 2012) putting the public health and livestock sector in jeopardy. With an ever growing population of the country, there is high effort by the livestock sector to cope with the protein demand and hence, high productive animals are reared under intensive farming system in urban and peri urban parts of the country such as Addis Ababa (Ameni et al., 2007; Elias et al., 2008). This, however, creates a favorable environment for diseases like bovine tuberculosis. M. bovis in cattle is pervasive throughout different agro ecological zones of Ethiopia where the BTB prevalence in cattle ranged from 16.2% up to 65.8% in different farming systems (Shitaye et al., 2007). Recently, high prevalence of 50% in intensive farms around the capital city has been reported (Firdessa et al., 2012). High BTB prevalence in humans was also observed 14 (29.2%) and 6 (17.1%) at the eastern Shewa and southeastern part of Ethiopia, respectively (Kiros, 1998; Kidane et al., 2002). Of an overall culture confirmed cases among children (34%) cases were due to M. bovis (CDC, 2014).
Many developed countries have succeeded in controlling BTB by implementing the test slaughter strategy paralleled with milk pasteurization. The culling of animals; however, presents financial challenge for developing countries like Ethiopia. Hence, there is a need to stick to the second resort i.e. pasteurization of milk; as this practice blocks the transmission path of M. bovis from animal to human with minimum cost (Cosivi et al., 1998; Firdessa et al., 2012). So far, different studies have indicated a critical knowledge gaps and the associated risky practice towards BTB in Ethiopia (Ameni et al., 2007; Tschopp et al., 2009). In fact, educational efforts in Ethiopia were reserved to addressing human to human transmitted TB even though the impact of TB from animal on human is not limited. While children are part of the community at risk of acquiring BTB (Dankner and Davis, 2000), health education remains a useful way in promoting awareness among themselves and even parents (Gopichandran et al., 2010). Yet studies on awareness and educational efforts among youth are not available. This study was, therefore, envisaged capturing the perception gaps among students towards animal TB and in comparison to human TB in Addis Ababa; in order to provide information for guiding educational endeavors.

Methodology

Study area, population, design, sampling technique and sample size

The study was conducted in Addis Ababa, the capital of Ethiopia from November 2013 to December 2013. The study had cross sectional design of public elementary schools in Addis Ababa. List of the schools was obtained from Addis Ababa education bureau, and five schools were selected by simple random sampling of schools. Two classes from each school representing the grades of interest were picked by convenience sampling of class, and all students in a class were handed to fill in questionnaire. As suggested by school heads and teachers, convenience sampling was conducted in those classes that were not engaged in teaching practice during the visit. A structured questionnaire was designed; pre tested and self-administered to ninth and tenth grade students in a local language (Amharic). The questionnaire consisted of basic questions to assess knowledge on transmission and cause of human and animal TB, source of information for acquired knowledge, and habits in usage of animal product. Targeted groups were believed to represent the elementary school and associated curricula. Only public schools were involved while private schools were excluded, as there was stringent process and long appointments besides problem of accessibility. the sample size was calculated considering 50% the expected awareness, 5% desired absolute precision and 95% level of confidence using single proportion population formula with an expected participation rate of 85% a targeted sample size of 384 was calculated and increased to 422. Data was entered into excel and transferred to be analyzed using SPSS software version 16. Chi
square test was used to test for difference between gender and grades, and awareness, attitude and practice. Statistical significance was set at p-value of 0.05.

Results

Demographic characteristics of respondents

A total of 409 students completed the questionnaire, 96.9% of the target sample size with 3.1% non-response rate. The age of participants ranged from 13 to 21 years with a mean 16.4. Of which, (41.3%) and (58.7%) were male and female, respectively. Participants represented tenth and ninth grades as depicted in Table 1.

Table 1 Characteristics of study participants in elementary schools in Addis Ababa, Ethiopia

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>169</td>
<td>41.3</td>
</tr>
<tr>
<td>Female</td>
<td>240</td>
<td>58.7</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9th</td>
<td>182</td>
<td>44.3</td>
</tr>
<tr>
<td>10th</td>
<td>212</td>
<td>51.8*</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤16</td>
<td>234</td>
<td>57.2</td>
</tr>
<tr>
<td>&gt;16</td>
<td>175</td>
<td>42.8</td>
</tr>
</tbody>
</table>

*The percentage is less than 100% because of missing values

Knowledge on human and bovine tuberculosis

Human TB was recognized by 99.5% of students, while only 13.9% had heard of animal TB. There was significant variation (p<0.05) between existing knowledge on MTB and BTB ($X^2= 613.9$, $P=0.0001$). Information on human and animal TB was obtained mainly from radio/TV (81.3%) and (75.4%), respectively. TB patients, school, flyers were also reported as information source (Table 2). Knowledge on the infectious cause of human and animal TB was known by 77.1% and 54.4%, respectively. However, misperceptions such as cold weather, locally termed as “Berd” were implicated as cause to human TB. Concerning the modes of human TB transmission, (98.3%) of respondents reported one or more ways. Nonetheless, inhalation was the commonly reported route of transmission in human (93.7%) as well as in bovine (28%) as depicted in Table 2.

Table 2 Knowledge towards TB and source of information for human and animal tuberculosis among 9th and 10th grade students in public school in Addis Ababa, Ethiopia

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>Types of TB</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Human TB</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$N=409$</td>
</tr>
</tbody>
</table>
Of all students, 320(78.2%) did not experienced TB themselves or among person they know while 89(21.7%) did; however, no association was seen (p>0.05) with their knowledge on bovine 11/57(19.3%) and human TB 89/409(21.7%). As shown in Table 3, Knowledge towards human TB and BTB was better in tenth (51.6%) and ninth grades (6.8%), respectively. Moreover, male had relatively better awareness on BTB (7.3%) while female had (58.4%) towards human TB. The knowledge variation across gender and grades; however, was not statistically significant (P>0.05).

Table 3 Knowledge and attitude towards human and bovine TB across genders and school grades from public school students, in Addis Ababa

<table>
<thead>
<tr>
<th>Variable</th>
<th>Grade</th>
<th>Characteristic</th>
<th>Gender</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9th grade N (%)</td>
<td>10th grade N (%)</td>
<td>p-value</td>
<td>Male N (%)</td>
</tr>
<tr>
<td>Heard of human TB</td>
<td>182(44.3)*</td>
<td>212(51.6)</td>
<td>P&gt;0.05</td>
<td>169(41.1)</td>
</tr>
<tr>
<td>Heard of bovine TB</td>
<td>28(6.8)*</td>
<td>25(6.1)</td>
<td>P&gt;0.05</td>
<td>30(7.3)</td>
</tr>
<tr>
<td>Knew the Public health</td>
<td>18(31.6)*</td>
<td>17(29.9)</td>
<td>P&gt;0.05</td>
<td>22(38.6)</td>
</tr>
<tr>
<td>importance of BTB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The percentage is less than 100% because of missing values**

Attitude and practice towards bovine tuberculosis

Of those who knew BTB, (66.7%) regarded it as a public health significant disease. The zoonotic implication of BTB was better known by ninth grades (31.6%) and male students (38.6%) as shown in
Table 3. However, no significance association was found. Informants believed susceptibility of cattle 33(62.3%) and other domestic animals such as dog 12(2.9%), cat 4 (1%) and other animals 4 (0.9%) to BTB. Meanwhile, only 27(47.3%) and 9 (15.8%) considered raw milk and yogurt as vehicles to M. bovis infection, respectively. As seen in Table 4, 66.2% used pasteurized milk products, while the rest consumed raw, yogurt, or mixed milk products. Of the respondents who had awareness towards human and bovine TB, (66%) and (56.1%) claimed to use pasteurized milk and milk products, respectively. Their awareness was not statistically associated with milk consumption habit (p>0.05).

Table 4 Attitude and practice towards BTB

<table>
<thead>
<tr>
<th>Variable (categories)</th>
<th>Number</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did not consider BTB as zoonosis</td>
<td>19</td>
<td>33.3</td>
</tr>
<tr>
<td>Consider raw milk as source of BTB</td>
<td>27</td>
<td>47.3</td>
</tr>
<tr>
<td>Perceive yogurt as vehicles to BTB</td>
<td>9</td>
<td>15.8</td>
</tr>
<tr>
<td>Milk consumption habit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pasteurized*</td>
<td>272</td>
<td>66.2</td>
</tr>
<tr>
<td>Raw</td>
<td>50</td>
<td>12.2</td>
</tr>
<tr>
<td>Yogurt</td>
<td>56</td>
<td>13.6</td>
</tr>
<tr>
<td>Mixed milk products**</td>
<td>24</td>
<td>5.8</td>
</tr>
<tr>
<td>Did not like milk at all</td>
<td>9</td>
<td>2.2</td>
</tr>
</tbody>
</table>

* Include pasteurized milk and milk products including heat treated milk at household level ** Refer both raw and pasteurized milk and milk products

Discussion

The present study revealed that overall students have heard of human TB (99.5%) while it was extremely low in BTB case (13.9%). In agreement with this study, Gopichandran et al., (2010) and Renuka and Muralidhar (2012); found a very impressive awareness on human TB among high school students in India. Nonetheless, Romha and colleagues, (2014) indicated a lower (29.7%) awareness on TB occurrence in animals among cattle owners in southern part of Ethiopia. Likewise, Munyeme and co-workers (2010) reported that 60.4% of respondents not to have heard of bovine tuberculosis from Zambia. The awareness variation seen in this study between the two types of TB could be a reflection of remarkable educational efforts towards the human TB through various mass Medias. In agreement with this premise, this study indicated the usefulness of electronic media in health education. More than 80% students reported to have acquired the awareness from TV and radio. Similarly, other investigators showed that health education means such as television (64.6%) can play a pivotal role in disseminating educational messages (Hoa et al., 2009). Nonetheless, Yadav and co-workers (2006) described that neighbors, friends and family members as major source of information in India. Thus, different
intervention means and efforts are suggested to consider the peculiar nature of each setting and target group (Hoa et al., 2009). In contrary, there is lack of attention towards bovine tuberculosis as part of educational endeavors. Although 45.6% did not know the actual cause of BTB, no false perception was found. Moreover, misperception as cold weather “berd” was implicated as cause of human TB. Similarly, Gebremariam et al. (2011) and Bati et al. (2013) had reported similar misperceptions among the general community in Addis Ababa and in south western part of Ethiopia (Gambella region).

Significant portions (21.7%) of students have closely witnessed TB case in person they know; however, there was no significant association with the existing knowledge. In agreement with this study, lack of knowledge on the cause (17.5%) and airborne transmission (5.3%) of pulmonary TB transmission was reported from Nepal among patients that have experienced TB themselves (Amgain et al., 2014). Similarly, the cause and transmission was known by 43.9% and 54.9% of TB patients in Tanzania, respectively (Wandwalo and Morkve, 2000).

In this document, the potential impact of bovine TB on human was not well known by students whereby (33.3%) believed no transmission from animal to human even among those who knew it existed. In line with this, Romha et al. (2014) and Bati et al. (2013) highlighted that only 22.9% and 16.6% of respondents had believed the fact that TB can be acquired from animals, respectively. Apart from the discrepancy due to the difference in the study population with varying cultural practice in the respective study areas, it also implicates the wide knowledge gap among the general community regardless of age group.

Mycobacterium bovis has been detected in milk and yogurt and hence, these products are regarded as sources of infection (Franco et al., 2013; Mariam, 2014). However, in this study, significant proportion (31.6%) used to consuming either raw or both pasteurized and raw milk products. Likewise, fewer than half considered raw milk (47.3%) and yogurt (15.8%) as infection source. TB cases are reported in different parts of the world due to habit of consuming raw milk (Cosivi et al., 1998; Kazwala et al., 1998; Kahla et al., 2011; Njarui et al., 2011; pal et al., 2014). Different studies have reported the culture of raw milk consumption in Ethiopia and potential transmission to humans (Ameni and Erkihun, 2007; Bati et al., 2013; Romha et al., 2014). Dankner and Davis (2000) reported M. bovis as a significant (34%) cause of TB among children raised in setting where raw milk is used. Herein, majority of students have indicated inhalation (28%) and ingestion (26.4%) as means of transmission of BTB giving less priority to the later route of transmission. In fact, BTB is transmitted primarily through ingestion of contaminated milk and milk products (Cosivi et al., 1998). Nonetheless, inhalation is a great concern to individuals having close contact with cattle (Acha and Szyfres, 2001) which is very unlikely in urban cities like Addis
Ababa and especially among youth. In our study, (93.7%) of all participants implicated inhalation as means of human TB transmission. Student’s belief on BTB transmission through inhalation could be attributed to their knowledge on human TB transmission having an indirect effect on bovine TB awareness provided that students had low awareness in BTB transmission though ingestion. On the other hand, students’ awareness on BTB may have influenced their practice towards pasteurized milk usage (56.1%); however, there was no statistical significance. This could have been influenced be a small sample size used in the study.

Taking into account the bad practice of milk usage and high prevalence in different farming systems (Shitaye et al., 2007), the potential risk of acquiring milk borne pathogens such as M. bovis to human is high (Ashford et al., 2001). Very recently, Firdessa and co-investigators (2012) reported high herd BTB prevalence (50%) among farms supplying milk to the capital city. The existing farms will seemingly continue to supply milk as well as M. bovis to the consumers as there are no control strategies in cattle and hence, suggested BTB control measures fitting in local context are urgently needed (Firdessa et al., 2012).

In this regard, one health oriented integrated researches are valuable to better understand the epidemiology and risk factors and also to inform policy as zoonotic health problems are shared between animals and humans. Such efforts involving both animal and public health sectors have been indicated as an ideal way of combating zoonoses including BTB (Zinsstag et al., 2008; Pal et al., 2014a). Various researches have been conducted work on human as well as bovine TB to build scientific knowledge in Ethiopia; however, educational efforts were merely confined to human TB. Such integrated efforts enabling prevention of many other zoonotic diseases such as brucellosis are very crucial (Plumb et al., 2013). In this context, health education need to be guided by the nature of the disease and not subjected to professional bias i.e. every health education on tuberculosis need to consider both human and animal TB as one.

As a limitation, only children of specific group (public school) of limited study area chosen by non-probability sampling were involved, therefore, our findings cannot be generalized to the whole area and age group.

In conclusion, the present study indicated lower knowledge among students on bovine TB than human TB. Due to concerted educational effort on human TB, students awareness has evolved when, ironically, on bovine TB is limited. Therefore, human TB awareness promotion strategy should be operated along with bovine TB under a One Health umbrella.
Acknowledgments

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Conflict of interest

The authors declare that they have no conflict of interest.

References

from both individual and collective bulk tanks at farms and informal markets in the southeast region of Sao Paulo, Brazil. BMC Veterinary Research 9: 85.


