Medical History of Meat Handlers and the Occurrence of Zoonotic *Mycobacterium bovis* Infection in Imo State, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A study on the medical history of meat handlers and the occurrence of zoonotic *Mycobacterium bovis* infection in Imo State, Nigeria was carried out using one thousand two hundred respondents. A cross sectional survey was carried out in the three (3) senatorial zones Imo state Nigerian and a multistage sampling technique was used to choose the abattoirs under study. A well structured questionnaire was distributed and the data analyzed. Results showed lack of BCG awareness (**OR=0.174; P=0.017**) to be statistically significant to the occurrence of bovine TB, on the other hand the range of the various times respondents go for medical checkups was considered; those who often attend medical checkup against those who always go for medical checkup (**OR=16.187; P=<0.0001**), also those who never go for medical checkup against those that had medical checkup three months ago (**OR=1.910; P=<0.001**). It was observed in this study that lack of BCG awareness and the care free attitude to medical checkup pose as a risk factor to *Mycobacterium bovis* T.B

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among meat handlers. Therefore, there is need to initiate an awareness program on the importance of BCG intake in the fight against *Mycobacterium bovis* T.B and improve existing diagnostic test to specifically deter early phase of the infection.

Keywords: Abattoir; bovine; zoonoses; tuberculosis; Odd Ratio (OR).

1. INTRODUCTION

There is increasing prevalence of unregulated and insanitary contact between humans and animals worldwide due to increasing population density and growth especially in developing countries where livestock offers important socioeconomic, cultural and religious pathway out of poverty [1]. The world Health Organization(WHO) estimated that in 2014 human TB incidence and mortality was 9.6 million and 1.5 million respectively [2] The prevalence of bovine tuberculosis(Btb) in some developing countries cannot be overemphasized in Mozambique, it is estimated to be 39.6% [3]. Whereas in Nigeria, the prevalence of bovine tuberculosis due to *Mycobacterium* ranges from 2.5 percent in 1970 to 14 percent in 2007. *M. bovis* has been a historical source of tuberculosis in human infection through drinking of contaminated unpasteurized milk or inhaling aerosols produced by diseased farm animals [4] and through consumption of improperly cooked infected meat and meat products [5,6]. The prevalence of tuberculosis is high, with the abattoir workers, cattle merchants and farm dealers being the group most exposed to the infection [7] it is imperative to understand that prior to the sale, cattle are raised and fattened in close proximity to farmer's home, after being sold to cattle merchants, they are kept within the vicinity of the merchants before being sold to butchers. These butchers, who spend greater hours at the abattoirs and the veterinary officers due to the nature of the work thereby, have ample opportunity for zoonotic transmission of infection [8]. They also eat with same hands due to poor food habits thereby ingesting the mycobacterium along with their food [9]. Recent study reported an association of bovine tuberculosis infection with non-vaccination of children with BCG, age, gender, physiological status and husbandry practices such as cattle movement and contact with wildlife, hence complicating the morbidity and mortality of tuberculosis cases [10]. The increase in human tuberculosis could be attributed to medical history, poverty, ignorance and lack of health facilities for routine health checks of farmers and abattoir workers [11].

In view of the above, this study is designed to determine the medical history of meat handlers with the occurrence of zoonotic *Mycobacterium bovis* infection in Imo State, Nigeria. The study highlights loopholes in the medical history of meat handlers and the demographic characteristics of these meat handlers in Imo State. The findings of this study would reveal the relationship between the medical history of meat handlers and the various demographic exposures that led to the occurrence of *Mycobacterium bovis* infection.

2. MATERIALS AND METHODS

A cross sectional survey design was used. Multistage sampling technique was used to select 1200 study participants; also a well structured questionnaire was used to determine the relationship between medical histories of meat handlers with the occurrence of Bovine TB in Imo State.

An informed consent was obtained from each respondent before data was collected and Ethical clearance was obtained from the gate keepers of the abattoirs. The data was analyzed using Statistical Package for Social Science (SPSS) version 20.0 computer software. The results were presented using simple frequency and percentages. Odd-ratio was used to test for the relationship between variables of interest and the occurrence of Bovine TB. P-value <0.05 was considered statistically significant.

2.1 Method of Data Analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 20.0 for both descriptive and inferential statistical analysis of variables. The analysis of the data was done in stepwise manner; bivariate and multivariate analyses using the logistic regression models to find the odds ratio for the association between risk factors and bovine TB. In the bivariate analysis, variables with p-value ≤ 0.25 [12] and those of known plausible biological contribution for bovine TB positivity such as age were subjected to Multivariate analysis to control for confounding and effect modification. Quantitative

data was analyzed descriptively using frequencies, mean and standard deviation. Also bar charts were used to present the frequencies. Data was also analyzed at 95% Confidence Interval and results were considered significant at p-value ≤ 0.05 .

Inclusion criteria

- 1) All meat handlers who are 18years and above present at the abattoir at the time, the study was carried out.
- 2) All meat handlers that gave their consent to the study.

Exclusion criteria

- 1) Meat handlers below 18 years of age.
- 2) All individuals at the abattoirs at the time this study was carried out who are not meat handlers.
- 3) Meat handlers' present but did not consent to the study.

3. RESULTS

3.1 Demographic Characteristics of meat handlers in Imo State

Out of the 1,200 subjects that responded, 592(49.3%) were between 41-60 years old, 563(46.9%) were between 20-40 years old, 33(2.8%) were above 60 years old, while 12(1.0%) were less than 20 years of age. The mean age of the respondents is 41.0 years (see Table 1).

On the account of their sex, 965(80.4%) of them were males while 235(19.6%) of them were females (See Table 1).

Based on their educational status, those that have secondary education were 605(50.4%), those that have primary level of education were 336(28.0%), while 259(21.6%) have tertiary level of education (see Table 1).

Based on their occupation, Meat vendors 568(47.3%), Butcher 451(37.6%), Transporters 164(13.7%), Veterinary attendants 17(1.4%).

With regards to the time frame of working in the abattoir, 617(51.4%) have spent more than 10 years working in the abattoir, 550(45.8%) have spent between 1-10 years in the abattoir, 33(2.8%) have spent less than one year working

in the abattoir, while. The mean length of time worked in the abattoir by the respondents is 18.2 years (see Table 1).

Table 1. Responses of subjects by socio-demographic characteristics (n =1,200)

Variable	Frequency	Percentage (%)
Age of respondents (41.0 $\pm$ 11.6)		
<20yrs	12	1.0
20-40 yrs	563	46.9
41-60 yrs	592	49.3
Above 60 yrs	33	2.8
Sex		
Male	965	80.4
Female	235	19.6
Marital status		
Single	190	15.8
Married	888	74.0
Divorced	22	1.8
Separated	66	5.5
Widow	34	2.8
Educational qualification		
Primary	336	28.0
Secondary	605	50.4
Tertiary	259	21.6
Occupation		
Butchers	451	37.6
Meat vendors	568	47.3
Veterinary	17	1.4
Attendants		
Meat transporters	164	13.7
Length of time worked at the abattoir (18.2 $\pm$ 12.7)		
<1 yr	33	2.8
1-10 yrs	550	45.8
Above 10yrs	617	51.4
Number of family members at home (6.9 $\pm$ 2.8)		
<5 persons	201	16.8
5-10 persons	944	78.7
Above 10persons	55	4.6

With regards to the household number, 944(78.7%) of them live with about 5-10 persons, 201(16.8%) of the study subjects live with less than 5 persons in their residents, while 55(4.6%) of them live with more than 10 persons in their homes. The mean number of persons living with the respondents is 6.9persons (see Table 1).

3.2 Distribution Based on the Medical History of Respondents

Out of the 1200 respondents, Most of them 1099 (91.6%) were aware of BCG, while 101(8.4%) are not aware.

Based on being vaccinated with BCG, 995(82.9%) had BCG vaccination during their childhood, while 205 (17.1%) were not vaccinated with BCG during their childhood.

With respect to having long lasted or bloody cough, Most of them 1046(87.2%) have not had long lasted or bloody cough, while 154 (12.8%) have had long lasted or bloody cough.

Results from Bovine TB treatment of household members, most of the respondents 1156 (96.3%) revealed that none of their family members have had Bovine TB treatment, while 44(3.7%) have had family members who had taken Bovine TB treatment.

With respect to frequency of their medical check-ups, most of the respondents 585 (48.8%) often go for medical check-ups, 478(39.8%) never go for medical check-ups and 137(11.4%) frequently go for medical check-ups.

Results from time –frame of respondent's last TB test, most of them 830(69.2%) had never ran a TB test, 179(14.9%) had TB test a year ago, 79(6.6%) had TB test 6 months ago and 56(4.7%) had TB test 3 months ago (see Fig. 1).

Table 2. Responses of subjects with respect to medical history (n =1,200)

Variable	Frequency	Percentage
Awareness of BCG		
Yes	1099	91.6
No	101	8.4
BCG vaccination during childhood		
Yes	995	82.9
No	205	17.1
Cough duration if yes		
1 month	44	3.7
3 months	55	4.6
None	1101	91.8
BTB treatment of any family member		
Yes	44	3.7
No	1156	96.3
Frequency of medical checkup		
Always	137	11.4
Sometimes	585	48.8
Never	478	39.8

Table 3. Bivariate analysis of the relationship between vaccination status of butchers and abattoir workers and the occurrence of bovine TB

S/N	Variable	Odds ratio (OR)	Confidence interval (CI): (95%)	P-value
1.	BCG awareness	0.174	0.041-0.730	0.017*
2.	BCG vaccination of family members	0.841	0.478-1.482	0.550
3	Frequency of medical check-ups			
A.	Often/Always	16.187	5.278-49.637	0.0001
B	Never/3months ago	1.910	1.642-2.221	0.0001

*Values significant at ≤ 0.05

Table 4. Multivariate analysis of the relationship between bovine tuberculosis and risk factors

S/N	Variable	Odds ratio (OR)	Confidence interval (CI): 95%	P-Value
1	No BCG awareness	0.096	0.027-0.336	0.0001
2	Gender (male)	2.405	1.368-4.227	0.002*
3	Frequency of medical check-up (sometimes)	0.899	0.567-1.425	0.650
4	Age of respondent (≥ 20 yrs/<20 yrs)	2.390	0.641-8.906	0.194
5	Last medical check-up (never/3months ago)	11.292	4.622-27.587	0.0001
6	Number of household members (>5/<5)	1.543	0.424-5.613	0.511

*Values that remained significant at ≤ 0.05 after the unconditional logistic regression model

Fig. 1. The last TB test done by the subjects

3.3 Bivariate Analysis of the Relationship between Medical Histories of Meat Handlers and the Occurrence of Bovine TB

When BCG awareness, was considered as a risk factor for bovine TB, result revealed (**OR=0.174; p=0.017**), hence lack of BCG awareness was statistically significant to the occurrence of bovine TB, this was in accordance with the study hypotheses. In the same vein, BCG vaccination of respondents has a protective effect on the occurrence of bovine TB (OR=0.841P=0.550) and this was keeping with previous study which stated that no BCG vaccination was 0.7 times associated with increased risk of exposure than those that have been vaccinated [10]. It also confirmed the previous study of Shitaye et al. [11]. that in general, tuberculosis can be effectively controlled through BCG vaccination.

Based on frequency of medical check-ups, the range of the various times respondents go for medical check-ups was considered as a risk factor; those that often go for medical check-ups against those that always go for medical check-ups, the result revealed (**OR=16.187; P=<0.001**), hence, it states that often times medical check-ups by meat handlers is statistically significant to the occurrence of bovine TB.

Also those that never go for medical check-up against those that had medical check-up 3

months ago, the result revealed (**OR=1.910; p=<0.001**), hence it states that never attended medical check-ups by meat handlers is statistically significant to the occurrence of bovine TB.

3.4 Multivariate Analysis of the Relationship between Bovine Tuberculosis and Risk Factors

After the unconditional logistic regression model, factors such as Lack of BCG awareness (OR= 0.096; CI= 0.027-0.336; P= 0.0001), Gender (male) (OR=2.405; CI= 1.368-4.227; P= 0.002) and Last medical check-up (never) (OR= 11.292; CI= 4.622-27.587; P= 0.0001) remained statistically significant among all factors that were significant at the bivariate analysis.

4. DISCUSSION

Findings from the study revealed that, 80.4% of the respondents were males while 1.96% of them were females, this however is in accordance with the study of Hambuolu et al. [12] which showed that abattoir workers are dominated by males in the middle age group.

Findings of the study also revealed that, 16.8% of the respondents lived with <5 resident members at home, 78.7% of them lived with between 5-10 household members, while 4.6% of them lived with more than 10 household

members, this agrees with the study of Ndukum et al. [13] in Cameroon that urban and peri-urban (compared to rural) livestock farming is fast-growing but most livestock professionals and handlers in Cameroun are small-scale farmers, nomads, herders, wage labourers and unemployed youths who are also poor and uneducated.

Findings from the study revealed that, BCG awareness have positive effect on the occurrence of bovine TB, this aligns with what was reported by Sa'idu et al. [9] in Bauchi, Nigeria, where 90.3% of the respondents were aware of the zoonotic nature of bTB.

Findings from this study also revealed that, BCG vaccination of respondents has a protective effect on the occurrence of bovine TB ($OR=0.841P=0.550$) and this aligns with the study of Kachalla, 2014a [10], that no BCG vaccination was 0.7 times associated with increased risk of exposure than those that have been vaccinated. It also confirmed the previous study of Shitaye et al. 2007a [11] that in general, tuberculosis can be effectively controlled through BCG vaccination.

Findings from the study also revealed that the diverse time range of medical check-ups showed strong statistical significance $P=0.0001$ with the occurrence of bovine TB.

5. CONCLUSION

This study has revealed factors such as masculinity, BCG unawareness and never going for medical check-up may promote bovine TB occurrence on butchers and abattoir workers. There is therefore need to initiate awareness campaign capturing enlightenment on these areas of deficiencies. This campaign should involve both governmental and non-governmental organizations and should also not be limited to only people in this occupation so as to reduce the risk of transmission of BTB within and outside this group of workers in Imo State, Nigeria.

CONSENT AND ETHICAL APPROVAL

A letter of introduction was obtained from the Department of Public Health, Federal University of Technology Owerri and was submitted to abattoir gate keepers. Ethical clearance was obtained from the gatekeepers of the abattoirs, the modalities for the survey were reached and

days for data collection fixed. Informed consent was obtained from each eligible abattoir worker before questionnaire administration and sample collection was done. Confidentiality of information obtained was assured and maintained.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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