

Knowledge and Awareness of Anthrax among the Community People at High, Medium and Low Risk Areas of Bangladesh

ABSTRACT

Aim: A cross-sectional survey was conducted to assess information about the awareness, attitudes and management practice towards Anthrax.

Methodology: Administrative areas of Bangladesh had been classified as high, medium, and low risk anthrax area by assessing the risk of anthrax from reports published in daily newspapers and journals. The selected high, medium and low risk areas were Kushtia, Pabna and Mymensingh. The animal owners and family members, butchers, affected people by cutaneous anthrax were considered as the key informants. Data of management practice including feeding, awareness of zoonosis; vaccination and formal education were collected using interview-questionnaire method. A total data of 622 was collected and uploaded to the data collection tools "Magpi" and the data analysis was carried out using Epi Info™. We found a great worry about educational status in our study sites. Among the interviewer, we found about Half of people had no formal education (46.46%, 289/622). Farmers from high risk districts significantly more aware of anthrax compared to those from medium-($p=0.000$) and low-($p=0.000$) risk districts. Knowledge of zoonosis of Anthrax and vaccination of Anthrax were also very poor among the people from low and medium risk areas. For treatment purpose, most of the farmers (About 98%) of high and low risk areas depend on village doctors. We also found that Improper washing of grass-($p=0.000$) and flood-($p=0.000$) were significantly responsible for Anthrax outbreak. Finally we suggest, proper washing of grass, increase awareness towards zoonosis of Anthrax and vaccination, proper treatment by veterinarian should be insure to reduce Anthrax outbreak in Bangladesh.

Keywords: Anthrax, Epidemiology, Zoonosis, Knowledge, Awareness, Bangladesh

1. INTRODUCTION

Anthrax (popularly known as - Torka, Duckmina, Duckshal, Dhash or Dharash in Bangladesh) is an acute disease caused by a soil-borne, aerobic, gram-positive, spore forming, non-motile and non-hemolytic bacterium, *Bacillus anthracis*. As a common problem, the disease naturally occurs around the globe. However, the disease is especially found in tropical and sub-tropical countries (Biswas et al., 2011). In many African and Asian countries, anthrax outbreak occurs periodically in animals, and subsequently transmits to human (WHO, 2008).

Until 2009, the disease was periodically reported in animals and human in Bangladesh (Ahmed et al., 2010). From 2010, frequent outbreak of Anthrax occurred enzootic. In 2010, there were 687 human cutaneous anthrax cases found. After 2010, total cases was 1320 until July 2016 (according to the Institute of Epidemiology, Disease Control & Research (IEDCR), Dhaka, Bangladesh; <http://www.iedcr.gov.bd>). Human anthrax in Bangladesh is intrinsically

related to enzootic anthrax afflicting livestock. This is because of very low vaccination coverage (Chakraborty et al., 2012) despite the country's routine anthrax vaccination program for livestock (Siddiqui et al., 2012).

On the country- side, people and their farm animals live in close vicinity and direct or indirect human contact with sick and diseased animals is frequent. Inadequate livestock vaccination coverage, butchering sick animals, disposing butchering wastes and carcass in the environment where animals graze, handling raw meat, contact with sick animals, social and environmental factor scarcity and limitation contributed to the outbreaks of anthrax in Bangladesh (Chakraborty et al., 2012; Islam et al., 2013).

Expectedly, the disease is more prevalent in the rural districts of Pabna, Sirajganj, Tangail and Kustia which support the country's largest cattle populations (Be-Nazir et al., 2010).

 *B. anthracis* forms spore in unfavorable conditions, which is resistant to heat and chemical disinfectants, and this may persist in soil as viable for several decades (Hirsh and Zee, 1999; Dragon et al., 2001; OIE, 2004). Favorable environmental conditions such as, soil pH, Ca content, moisture, soil type, high ambient temperature and rainfall and topography are positively correlated with the persistence of anthrax spores and subsequent outbreaks (Van Ness, 1971; Hugh Jones, 2002; Ahsan et al., 2013).

Primarily, herbivores like cattle, sheep, goat, horse and pig are affected with anthrax (Ahsan et al., 2013) and the disease is usually fatal in ruminants (Islam et al., 2013).

It has been reported elsewhere that this human behavior is partly influenced by lack of awareness (Mosalagae et al. 2011), perceptions, and attitude (Opare et al. 2000, Shirima et al. 2003, John et al. 2008), and/or misconceptions (2003) about zoonosis. Hence, it is important for cattle owners to acquire a certain degree of awareness of livestock diseases in their areas, the risks they pose, and possible transmission routes to humans, if they are to make informed decisions on diseases suspected to have zoonotic potential. Although a few relevant studies in communal areas have focused on risk factors in the face of human anthrax outbreaks (Mwenye et al. 1996, Gombe et al. 2010), information is not available regarding the level of public awareness and the risk of anthrax in these rural communities. Thus, the objective of this study was to assess cattle owners' awareness, perceptions, and attitudes toward zoonosis with particular reference to anthrax in low-, medium-, and high-anthrax (Chikerema et al. 2012) outbreak settings. It is envisaged that the baseline information generated will facilitate the development of effective guidelines and policies for controlling anthrax outbreaks.

58

59 2. MATERIAL AND METHODS

60

61 2.1 Geography of the study area

Administrative area in Bangladesh have been classified as high, medium, and low risk anthrax area by assessing the risk of anthrax and from reports published in daily newspapers and journals. On the basis of this classification, high, medium and low-risk areas were randomly selected. The selected high-risk area were Kushtia, whereas Pabna were the selected as medium-risk areas and Mymensingh was selected as low risk area (Fig. 1).

Although there had no clear cut written document of cattle outbreak of Anthrax case during the period 2009 to July 2015, we considered human outbreak as key to assess risk areas. As  well as also there had little outbreak occurred during these year in Pabna, we consider this area as medium risk. On the other hand, In our low risk area, Mymensingh, there had no report of Anthrax outbreak found. Each time, the study team visited the reported areas and collected information by android data collection tools (Magpi 2016) and susceptible samples for subsequent analysis. The study team firstly visited the human and livestock officials of the particular areas. The animal owners and their family members, people associated with

slaughtering, butchering, handling and eating the meat of affected animals, people who developed lesions of cutaneous anthrax and were considered as the key informants.

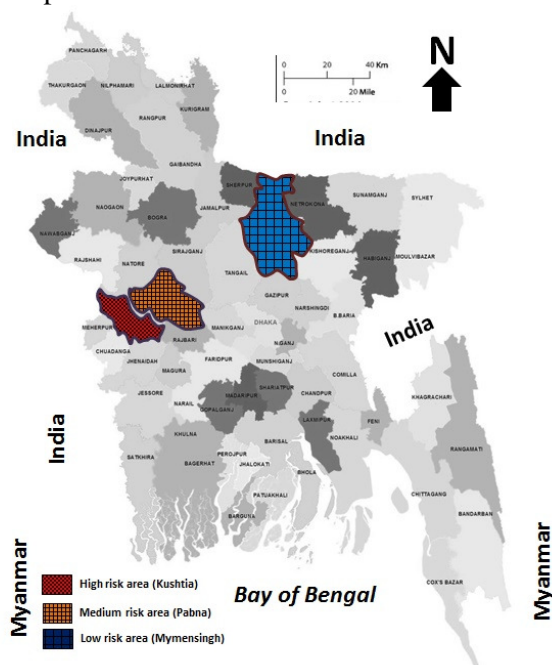


Figure 1. Study areas in Bangladesh. The figure indicates high, medium and low risk areas of anthrax in Bangladesh.

2.2 Data collection and survey methods

A cross-sectional survey was employed to collect data from the respondents. A semi structured, open-ended questionnaire was developed to gather information on the awareness, perceptions, and attitudes towards zoonosis by farmers and management practice, feeding habit, environmental conditions such as heavy rainfall and flooding etc. The questionnaires were uploaded to the data collection tools (<http://Magpi.com>) and data were collected by Magpi android data collection application. The questionnaire was completed by two trained veterinarians during interviews with the farm owners and uploaded instantly from the place where interview performed through internet. Population statistics of the farms were collected, and Global Positioning System (GPS) coordinates were recorded.

2.3 Data analysis

The data was extracted from Magpi server as Microsoft Excel database. Data analysis was carried out using Epi Info™ (Epi Info™ is a trademark of the Centers for Disease Control and Prevention (CDC) used version 7.1.5.2) for Windows to generate descriptive statistics (frequencies/proportions) related to the cattle owners' awareness of zoonosis, management practice, feeding habit, environmental conditions, time of occurrence of anthrax, routes of transmission of the disease, consumption habits, family and community-based activities which have increased risk of contracting anthrax, treatment-seeking behavior, and prevention of anthrax.

In addition to questionnaire information, data on anthrax outbreaks and cases in cattle and humans in the studied area were also extracted from the monthly reports of the Division of Livestock Production and Veterinary Services in respective area and various articles paper.

3. RESULTS

3.1 Outbreak occurrence among people during 2010-2015

Table 1 summarizes the number of participants involved in the survey and anthrax data of the studied area for the period January 2009 to July 2015. During this period, the high risk anthrax districts accounted for 65% of the human outbreaks in the studied districts, followed by the medium-risk districts (35%); the low-risk districts no human outbreaks were recorded in Mymensingh. A total of 22.35% (139/622) of the farmers were from anthrax high-risk area, while 40.03% (249/622) were from medium risk area and 37.62% (234/622) were from low risk areas respectively. Out of the 623 farmers, 610 (97.92%) were males and 13 (2.08%) were females. Thirty percent of the farmers were between 20 to 34 years of age (considered as young) and mostly Sixty seven percent are between 35 to 50 years of age (Middle age) and rest three percent are above 50 years (Considered as old). We found a great worry about education status in our study site. Among the interviewer, we found in Pabna, about half of people had no knowledge of education (51.81%, 124/249) and in Kushtia the percentage is more than half (60.43%, 84/139). But in Mymensingh the overall situation is better than others two. We found in Mymensingh, less than 34% people are illiterate (81/234). In general, the interviewed farmers had small herd sizes, with the majority (>70%) having 2–3 cattle.

Table 1.

	Area	No. of interviewer	Human Outbreak number						Total
			2015	2014	2013	2012	2011	2010	
High risk	Kushtia	139	13	0	0	5	0	49	67
Medium risk	Pabna(Santhia)	249	0	0	0	0	2	35	37
Low risk	Mymensingh	234	0	0	0	0	0	0	0

General awareness about Anthrax and zoonotic knowledge:

Overall, farmers from anthrax high-risk districts were significantly more aware of anthrax compared to those from medium- ($\chi^2 = 32.261$, degrees of freedom [df] = 1, $p = 0.000$) and low- ($\chi^2 = 84.826$, df = 1, $p = 0.000$) risk districts (Table 2). Similarly knowledge of zoonosis of Anthrax is very poor among people from ($\chi^2 = 30.818$, degrees of freedom [df] = 1, $p = 0.000$) and low- ($\chi^2 = 82.221$, df = 1, $p = 0.000$) risk districts compared to high risk area (Table2).

Table 2. Knowledge and awarness on anthrx among the study people

Area	Number of People know about Anthrax			Number of People know about zoonosis of Anthrax		
	Number	Total	Percentage (%)	Number	Total	Percentage (%)
Kushtia	103	139	74.10	91	139	65.47
Pabna	110	249	44.18	90	249	30.82
Mymensingh	59	234	25.21	44	234	18.22

Awareness of vaccination:

We had also tried to assess vaccination knowledge of the farmers in selected areas. In high risk areas, more than 70% farmers (101/139) knew about availability of Anthrax vaccine.

Most vaccine was given by government vaccinator (132/139, 94.96%). But Farmers claim that vaccinator perform mass vaccination to the areas only when outbreak had occurred. There have few (30.2% agreed) vaccination society in high risk areas where mass vaccination occurs by farmers own effort but this is not enough. On the other hand, in medium risk areas, very few farmers (only 21.29%, 53/249) know about Anthrax vaccine. Only (25/249, 10%) farmers perform vaccination by government vaccinator and there has no such vaccination society. In low risk area, the number of farmer knows about Anthrax vaccine was negligible (2/234, 0.85%) and there has no vaccination society as well.

Management practice:

For treatment purpose most of the farmer of high and low risk areas depends on village doctor (135/139, 97.12% in Kushtia, 246/249, 98.80% in Pabna). But in Mymensingh, the scenery was different. About 52.14% people goes for veterinary surgeon and rest for village doctor. For reason, People say there has a veterinary hospital available named “BAU veterinary teaching hospital” where they mostly went for treatment. Although about 46.55% people cannot but went to village doctor also. In high risk areas, most people provide both grass and concentrate (127/139, 91.37%), but washing of grass with pure water is not practiced properly (105/139, 75.53%). In medium and low risk areas, the number are respectively (126/249, 50.60%) And (61/234, 26.07%). Improper washing of grass is one of another factor of Anthrax transmission. For improving feed value, most farmers use feed supplement in cattle feed, most used feed supplement are rice straw (88.46%), rice husk (85.04%), wheat barn (72.22%) and oil cake (14.95%). Vulture which is called natural cleaner is not seen by the farmers (575/622, 91.44%) in these areas.

Other management practice

Table 3. Management practices by the people considering anthrax outbreak

Factore	Areas	Number of people say Yes	Total	Percentage(%)
Bathing in fresh water	Kushtia	87	139	62.59
	Pabna	126	249	50.60
	Mymensingh	224	234	95.73%
Floor type: Concrete	Kushtia	87	139	62.59
	Pabna	167	249	67.06
	Mymensingh	127	234	54.27%
Use of bedding	Kushtia	39	139	27.86%
	Pabna	186	249	74.70%
	Mymensingh	182	234	77.78
Occurrence of flood	Kushtia	99	139	71.22
	Pabna	86	249	90.53
	Mymensingh	0	234	-
Frequency of grazing	Kushtia	6	139	4.32
	Pabna	11	249	4.41
	Mymensingh	132	234	56.41%

4. Discussion

The results of this study demonstrated that anthrax awareness among cattle owners is high in Kushtia (a high risk areas), but low in Pabna (a medium risk areas) and Mymensingh (a low risk areas). So it differs depending on incidence of the disease in a particular area. Lack of Efficacy of human anthrax treatment (Chikerema et al., 2013), inadequate vaccination program, no adequate washing of soil in grass before feeding, lack of awareness of Anthrax disease and transmission (Hassan et al., 2015), slaughtering of moribund cattle (Chikerema et al., 2012), selling meat from cattle that died of unknown causes to the community (Chikerema et al., 2012) were found to be major reasons for repeated outbreak of Anthrax. In many developed countries, human anthrax has been virtually eliminated because of effective control measures, including human and animal vaccination, governmental law and veterinary supervision of animal slaughter and quality control of animal products (Turnbull et al. 1999). Also consumption of meat from animals that died of unknown causes as a discouragement from veterinary officials, introducing veterinary-supervised meat inspection services (Chikerema et al., 2013) is likely to help in preventing human anthrax outbreaks. Also encouraging awareness of animal vaccination and disposal of anthrax-infected carcasses by proper method (Hassan et al., 2015), human anthrax could be preventable in the studied areas. Education, awareness and collaboration between human and animal health workers were considered to be important in combating the disease (Chikerema et al., 2013). In addition, strict and powerful guidelines for the slaughter, disposal, and quarantine of domestic animals suspected to have anthrax would be beneficial. Furthermore, slaughtering and butchering livestock, careful monitoring should be beneficial for reducing cutaneous Anthrax outbreak among community.

5. CONCLUSION

From analyze factor associated in repeated outbreak of Anthrax, we suggest, proper washing of grass, increase awareness towards zoonosis of Anthrax and vaccination, proper treatment by veterinarian, improve management practice should be insure to reduce Anthrax outbreak in Bangladesh.

ETHICAL APPROVAL

Not applicable

REFERENCES

1. Biswas PK, Islam MJ, Shil SK, Chakraborty RK, Ahmed SSU, Christensen JP. Risk factors associated with anthrax in cattle on small holdings. *Epidemiology and Infection.* 2011;140:1888-1895.
2. Ahmed N, Sultana Y, Fatema DSM, Ara K, Begum N, Mostanzid SM, Jubayer S. Anthrax: An emerging zoonotic disease in Bangladesh. *Bangladesh Journal of Medical Microbiology*, 2010;4:46-50.
3. Chakraborty A, Khan SU, Hasnat MA, Parveen S, Islam MS, Mikolon A, Chakraborty RK, Ahmed BN, Ara K, Haider N, Zaki SR, Hoffmaster AR, Rahman M, Luby SP, Hossain MJ. Anthrax outbreaks in Bangladesh, 2009-2010. *American Journal of Tropical Medicine and Hygiene*, 2012;86:703-710.
4. Siddiqui MA, Khan MA, Ahmed SS, Anwar KS, Akhtaruzzaman SM, Salam MA. Recent outbreak of cutaneous anthrax in Bangladesh: clinico-demographic profile and treatment outcome of cases attended at Rajshahi Medical College Hospital. *BMC Research Notes.* 2012;5, 464.

- 225 5. Islam MS, Hossain MJ, Mikolon A, Parveen S, Khan MSU, Haider N, Chakraborty A,
226 Titu AMN, Rahman MW, Sazzad HMS, Rahman M, Gurley ES and Luby SP. Risk
227 practices for animal and human anthrax in Bangladesh: an exploratory study. *Infection*
228 *Ecology & Epidemiology*. 2013;3:21356. doi: 10.3402/iee.v3i0.21356.
- 229 6. Be-Nazir A, Sultana Y, Fatema D, Ara K, Begum N, Mostanzid SM, Jubayer S. Anthrax:
230 an emerging zoonotic disease in Bangladesh. *Bangladesh Journal of Medical*
231 *Microbiology*. 2010;04:46-50.
- 232 7. Hirsh DC, Zee YC. The Genus *Bacillus*. In: *Veterinary Microbiology*. Ernst L, Berstain
233 B, Hirsh DC(ed.). Blackwell Science Inc. USA. 1999;246-249.
- 234 8. Dragon DC, Rennie RP. Evaluation of spore extraction and purification methods for
235 selective recovery of viable *Bacillus anthracis* spores. *Letters in Applied Microbiology*
236 2001;33:100-105.
- 237 9. *Manual of Standards for Diagnostic Tests and Vaccines* (5th ed). Chapter 2.2.1, OIE,
238 France. 2004;283-294.
- 239 10. Van Ness GB. Ecology of anthrax. *Science*, 1971;172:1303-1307.
- 240 11. Hugh-Jones ME, de Vos V. Anthrax and wildlife. *Revue scientifique et technique*,
241 2002;21:359-383
- 242 12. Ahsan MM, Khan MFR, Rahman, Hassan J, Chowdhury SMZH, Parvej MS, Jahan H,
243 Nazir KHMNH. Investigation into *Bacillus anthracis* spore in soil and analysis of
244 environmental parameters related to repeated anthrax outbreak in Sirajganj, Bangladesh.
245 *The Thai Journal of Veterinary Medicine*, 2013;43:449-454.
- 246 13. Hassan J, Ahsan MM, Rahman MB, Chowdhury SMZH, Parvej MS, Nazir KHMNH.
247 Factors associated with repeated outbreak of anthrax in Bangladesh: qualitative and
248 quantitative study. *Journal of Advanced Veterinary and Animal Research*, 2015;2(2):158-
249 164.
- 250 14. Chikerema SM, Matope G, Pfukenyi DM. Awareness and attitude toward zoonoses with
251 particular reference to anthrax among cattle owners in selected rural communities of
252 Zimbabwe. *Vector Borne Zoonotic Disease* 2013;13,243-249.
- 253 15. Mosalagae D, Pfukenyi DM, Matope G. Milk producers' awareness of milk-borne
254 zoonoses in selected smallholder and commercial dairy farms of Zimbabwe. *Tropical*
255 *Animal Health and Production* 2011;43:733-739.
- 256 16. Opore C, Nsiire A, Awumbilla B, Akanmori BD. Human behavioural factors in outbreaks
257 of human anthrax in the Tamale municipality of northern Ghana. *Acta Tropica*
258 2000;76:49-52.
- 259 17. Shirima GM, Fitzpatrick J, Cleaveland S, Kambarage DM. Participatory survey on
260 zoonotic diseases affecting livestock keeping communities in Tanzania. *Journal of*
261 *Animal and Veterinary Advances* 2003;2:253-258.
- 262 18. John K, Kazwala R, Mfinanga GS. Knowledge of causes, clinical features and diagnosis
263 of common zoonoses among medical practitioners in Tanzania. *BMC Infect Dis*
264 2008;8:162.
- 265 19. Mwenye KS, Siziya S, Peterson D. Factors associated with human anthrax outbreak in the
266 Chikupo and Ngandu villages of Murewa District, Mashonaland East. *Central African*
267 *Journal of Medicine* 1996;42:312-315.
- 268 20. Gombe NT, Nkomo BMM, Chadambuka A, Shambira G. Risk factors for contracting
269 anthrax in Kuwirirana ward, Gokwe North, Zimbabwe. *African Health Sciences*
270 2010;10:159-164.
- 271 21. Chikerema SM, Pfukenyi DM, Matope G, Bhebhe E. Temporal and spatial distribution of
272 cattle anthrax outbreaks in Zimbabwe between 1967 and 2006. *Tropical Animal Health*
273 *and Production* 2012;44:63-70.

- 274 22. Turnbull PC, Hugh-Jones ME, Cosivi O. World Health Organization
275 activities on anthrax surveillance and control. Journal of Applied
276 Microbiology 1999;87:318-320.