
THE ROLE OF ZONOTIC AND PARASITIC AGENT IN BIOTERRORISM THE NEED FOR BIOSECURITY AND BIOSAFETY STANDARD AND COMPLIANCE IN NIGERIA

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ABSTRACT

As a result of new world era of terrorism in 21st century; terrorist have employed different types of weapons to kill and maim people in soft targets. The risk posed by biological agents as a weapon needs evaluation both historical and technological for a better understanding. From historical and technological point of view biological agents are more dangerous and more devastating than other weapons of warfare. The relative ease of production and readily available sources of acquisition coupled with the technical know-how encourages the proliferation of biological weapons. This paper focuses on the role of biological agents (zoonoses and parasites) in bioterrorism the need for biosafety standard compliance to further reduce threat on biosecurity in Nigeria and Africa in general. The threat and antics of bioterrorism is very important and must be taken seriously by all nations.

Keywords: Biosecurity, Zoonotic, Parasitic agent, Bioterrorism, Biosafety, Nigeria

INTRODUCTION

The term biosecurity is a concept introduced in 1993 by agricultural and environmental biology communities in response to the threat of biological terrorism (Koblentz, 2012). The term also covers the prevention of international removal (theft) of biological materials from research laboratories. It also involves policies and measures taken to protect people natural resources, plants and animals against potentially harmful species and diseases from other countries. The crude concept of biosecurity mainly involved quarantine stations and, border inspection which was basically for economic purpose aimed at protecting the agricultural products, horticultural and forestry industry from exotic pets and disease control (Lakoff and Collier, 2008).

Biological materials include biological particles, prokaryote, protocista, fungi, plant, animals and among this living and biological particles are some that produces diseases in

plant and animal including man and his domestic animal. Infectious diseases caused by biological agent in the prehistoric era (about 5000 BC) were believed to cause by superstition, religion, magic and witchcraft. Infectious diseases were first recognized to be transmissible to people by the armies in early 600 BC. When crude use of filth and cadavers, animal carcasses, and contagion was used to devastate and weaken the enemy (Robertson and Robertson, 1995). In the ancient times to 20th century polluting wells and other sources of water as well as common food sources and supplies with infectious biological agents was a common strategy employed in many European wars and American civil war.

The first recorded biological warfare attack was in 1346, during the siege, a well-fortified Genoese – controlled seaport (Feodosija in Ukraine) attacking Tartar force experience devastating epidemic of plague (Wheelis, 2002). The Tartar forces were not deterred but rather converted their misfortune

into an opportunity by catapulting the cadavers (dead bodies of epidemic victim) into the city, thereby initiating a plague epidemic in the city, the plague outbreak that followed their action forced Genoese forces to retreat (Wheelis, 2002). The plague pandemic, (aka Black Death) swept through Europe, the Near East and North Africa in the 14th century which racks the most devastating public health disaster in recorded history. Although the source or origin of the plague was not known at that time several countries that shares common boundaries with Ukraine such as the Far East, China, Mongolia, India and Central Asia were suggested (Riedel, 2004; Willey *et al.*, 2011). During the event the author of *Gabriel de Musses* suggested two likely route with which the plague spread: (i) the plague was transmitted to the citizens of Caffa by the hurling of diseased cadavers into the besieged city, and the inhabitants fleeing from Caffa brought the plague into the Mediterranean seaport and (ii) ships carrying plague – infected refugees alongside pest (i.e. rodents and arthropod) sailed to Constantinople, Genoa, Venice, and other Mediterranean seaports to cause the second pandemic the multiplier effect of biological weapon.

Given the complex ecology and epidemiology of plague it is noteworthy to assume that a single biological attack was responsible for plague epidemic in Caffa and even beyond the 14th century plague pandemic in Europe. However considering the crude method owing to the technology available at that time it was still effective reminded us of the terrible and how devastating a biological weapon could be. The plague epidemic and pandemic in Europe killed more than 25 million people women and children in 14th and 15th centuries, many other incidents indicated various uses of disease caused by biological agent to wedge war. On numerous occasions during the past 2000 years, the use of biological agent in the form of disease, filth, and animal and human cadavers has been recorded in history (Willey *et al.*, 2011).

In the past biosecurity was mainly for economic growth and benefit with little or no attention to the public health implication increase in invasive species and technology,

growth of trade and general apprehension of the society in recent time created a new world era of terrorism equally increased the chances of new and emergent methods of terrorists attack and proliferation of dangerous biological weapons; hence the need to generate more information and data that will alert the general public toward ensuring biosecurity awareness and biosafety compliance.

The emergence of different terrorist groups all over the world without value for their lives talk less of their innocent, peaceful target with different kinds of weapons – bombs, guns and explosive which is already known and proactive method applied to checkmate them.

It is important to review and make available information in this neglected aspect of weapons of terror biological agent despite being most dangerous. Review the historical threat of bioterrorism using biological agent. Suggest ways and methods to addressing the threat, through recognition and prompt intervention.

MATERIALS AND METHODS

Historical method will be applied. Many articles reviewed starting from the discovery of biological agents the natural and synthesized biological agent. Report in periodicals and text were also reviewed to extract necessary information.

RESULTS

Zoonoses: These are animal diseases that are transmissible to humans. About 75 % of emerging human infectious diseases are thought to have come from animals, including, wild life. Most at risk of contracting zoonoses are people in close contact with animals or animal products. This includes veterinarian, farmers, abattoir workers, shearers, wildlife cares and pet owners. Important zoonotic diseases of public health concern include; Anthrax (*Bacillus anthracis*), Brucellosis (*Brucella* spp.), Psittacosis / Ornithosis (*Chlamydomphila psittaci*), Quarry fever (*Coxilla burnetti*) and Tularemia (*Francisella tularensis*), Borrellosis (*Borrelia burgdorferi*), Tuberculosis (*Mycobacterium bovis*, *Mycobacterium*

tuberculosis), Plague / Bubonic (*Yersinia pestis*), Typhus fever (*Rickettsia mooseri*), Yellow fever (*Yellow fever virus*), Sever Acute Respiratory Syndrome (SARS) (*Coronavirus*), Influenza (Influenza virus), Herpes B viral encephalitis (*Herpes virus simiae*), Ebola viral disease (*Ebola virus* spp.), HIV/AIDS (Human immunodeficiency virus) etc. The above disease are originally disease of non-human host such as cattle, horses, sheep, swine, goats, dogs, cats, wild animals, birds, bats, fowl, deer, rabbits, farm animals, pets, rodents, monkeys, armadillos, arthropods, pangolin etc. which can infect and establish itself in human. Majority of these diseases are transmitted to man through droplets from air and some are highly contagious in nature (Wagar *et al.*, 2010).

Restrictions on Zoonoses and Parasite Agent in Bioterrorism:

The use of biological agents to effect personal or political outcome is not new in this 21st century. The most notable intentional uses of biological agents for criminal or terror intents are global phenomena; despite bio-defensive program established in 1953 and bio-offensive program and lunched in 1969 and biological weapons conventions signed by 103 nation rectified in Geneva conventions in 1975, the use of biological materials as weapon of warfare and terrorism has not been put to check. In recent times precisely starting from 1970s the world have recorded many incidence of intermittent use of biological agent especially zoonoses and other biological material to perpetuate terrorist act (Table 1).

Helminths as Potential Biological Weapon:

The twenty first century age of terror focuses on bio-weapon has been largely directed towards bacterial and viral agents as recorded above as well as biological toxins such as prions and fungal pathogen have also been discussed to a limited extent (Rotz *et al.*, 2002; Paterson, 2006; Ryan and Glarum, 2008). Helminth despite its public health impact has failed to receive attention as a bio-weapon (Phills *et al.*, 1972). Helminths pose a number of important characters that made them theoretical potential

bio-weapons. The mode of transmission of helminths parasite to human is through ingestion with food items reduces the risk of handling during weaponizing. On like stochastic biological agent, helminths are taxonomically diverse and ubiquitous, and domestic and or cosmopolitan species are easily collected (Lustigman *et al.*, 2012). This is a pointer to the fact that sourcing such agents is cheap, simple and can be done without being noticed by security organizations that control and regularized its handling (Bowman, 2014). Various helminths are known to have a range of distressing and often stigmatizing effects on those infected ranging from larval migrants and neuropathological symptoms and disease caused by many species also has delayed onset, signs and symptoms which are often difficult to distinguish from those other common disease (Hotez *et al.*, 2008).

Among helminths parasite few may be used for bio-weaponization. These potentially helminths share a number of common similarities, namely ubiquity, ease of weaponization and high pathogenicity. The common characteristics of ubiquity suggest that the parasite affect either domestic animal or human in developing countries. Although the ease of weaponization of helminths may be a lot more difficult in that those under taking the weaponization processes must understand the method of collecting different species, preparation of the infective stages and method of dispersal.

These would be based upon the complexity of the technical and knowledge regarding helminths biology as well as parasitological knowledge of the helminths species that would be used (Kwak, 2016). Helminths group is taxonomically diverse and potentially dangerous and found everywhere, commonly being found in domestic or cosmopolitan species and are easily collected. Research into the fundamental and applied biology of many helminths parasites, techniques have also been developed for in-vitro culturing of many common species (Smyth, 1990).

Table I: Global history of bioterrorism

Year	Country/city	Type of biological material used
1978	London	Injection of ricin by Bulgarian exile
1979	Sverdlovsk USSR	Accidental release of anthrax, with 40 fatalities.
1984	The Dales Oregon USA	The use of <i>Salmonella enteric</i> serovar Typhimurum in 10 restaurant salad bar by Rajneeshee religion cult.
1991	Minnesota USA	Resurface of ricin toxin.
1994	Tokyo Japan	The use of Sarin and other biological agent by unknown assailant
1995	Arkansas USA	Reappearance of ricin toxin in the city.
1995	Indiana USA	Release and purchase of <i>Yersinia pestis</i>
1996	Texas USA	Use of <i>Bacillus anthracis</i> spores delivered through the U.S. Postal system by unknown person though FBI named Bruce Ivins.
1997	Washington DC	Scar of Anthrax / plague in the city.
1998	Nevada	Release of Non-lethal strain of <i>B. anthracis</i> .
1998-1999	USA	Multiple Anthrax hoaxes
2001	USA	Anthrax outbreak in USA

Source: Rotz *et al.* (2002)

Table 2: Potential suitable helminths used as biological weapon

Species	Group	Distribution	Final Host (s)	Diseases
<i>Taenia solium</i>	Cestode	world wide	Pigs	Cysticercosis
<i>Spirometra spp.</i>	Cestode	North America and Australia	Canids, Felids Raccoons	Sparganosis
<i>Echinococcus multilocularis</i>	Cestode	World wide	Canids and felids	Alveolar echinococcus
<i>Echinococcus granulosus</i>	Cestode	Worldwide	Canids	Unilocular hydatidosis
<i>Faciola hepatica</i>	Trematodes	World wide	Cattle, goat, sheep kangaroos, pigs	Facioliasis
<i>Schistosoma mansoni</i>	Trematodes	World wide	Humans	Schistosomiasis
<i>Ascaris suum</i>	Nematode	World wide	Human	Ascariasis
<i>Ascaris lumbricooides</i>	Nematode	World wide	Raccoons	Ascariasis
<i>Baylisascaris procyonis</i>	Nematode	North America Europe and Japan	Dogs	Cysticercosis

Source: kwak (2016)

Most bioterrorism attack target human population, but in some cases livestock and domestic animals which is the major source of animal protein may also be targeted. For easy understanding and better illustration a list of some species with traits of being used for biological weapon with their basic logical data has been presented in literature (Cram, 1943; Sorvillo *et al.*, 2002).

Biosafety and Biosecurity Compliance: The challenge of biosecurity is that harmful technology is becoming more available and accessible (Jefferson *et al.*, 2014). Although biomedical advances and the globalization of scientific and technical expertise have made it possible to greatly improve public health, there is also the risk that these advances can make it easier for terrorist to produce biological

weapons (Institute of Medicine, 2006). The proliferation of high biosafety level laboratories around the world has made experts worried about availability of targets for those that might be interested in stealing dangerous pathogens and emerging and re-emerging diseases is also a serious biosecurity concern. Research into biosecurity and biosafety conducted by the United Nations, University Institute for the advanced study of sustainability (UNN-IAS) emphasized on long-term consequences of the development and use of biotechnology and need for an honest broker to create avenues and forums to unlock the impasses.

Proactive Measures: Bio-Response report card produced in 2001 by the centre for the weapon of mass destruction (WMD) stated that the major challenges to biosecurity are:

Attribution; communication; Detection and diagnosis; Environmental cleanup; Medical countermeasure availability; Medical countermeasure development and approval process; Medical counter-measure dispersing; Medical management.

Communication between policymakers and life sciences scientists is also important (Benson and Roger, 2014). Communication between the citizen and law enforcement officials is imperative. Indicators of agro-terrorism at a food processing plant may include persons taking notes or photos of a business, theft of employee uniforms, employees changing working hours, or persons attempting to gain information about security measure and personnel. Unusual activity should be reported to law enforcement personnel promptly (Byrne, 2010; BRRC, 2011). Generally life sciences and biotechnology has brought a lot of benefit to mankind through responding to societal challenges. Implanting such advocacies could be exploited for hostile purposes, as may be seen in number of reviewed cases of bioterrorism and series of large scale offensive biological warfare programs carried out in recent times round the globe and still ongoing. However, major ways in ensuring that the life sciences continue to generate great benefits instead of becoming subject of misuse for hostile purposes a process of engagement between scientist and the security community and the development of strong ethical and normative frame work to compliment legal and regulatory measures that are being developed (Nasim *et al.*, 2013).

Conclusion: Having exhausted the risks and the enormous threat of Biological weapon its implications on public health, strategies must be develop to prevent the proliferations of biological agent. A multidimensional based involving formulation of a global norm that forbid proliferation of biological weapons; establishment of surveillance and reporting system that can identify bio-weapon use and improve diagnosis and capacity to effectively respond to the public health need should the need arises. Finally the disabled victims of bio-terror attack should be rehabilitated and our medical system should be equipped with current

diagnostic tools and therapeutic centers to forestall any unwarranted event should the unexpected happen.

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