Turkish Journal of Forensic Science and Crime Studies

ISSN: 2687-3397
Year: 3, Volume: 3, Issue: 1-2, December 2021 p.97-106 Article Type: Review
Received Date: 04.11.2021 Accepted Date: 04.12.2021

The New Face of Terror: Biological Terror

Aybüke A. İsbir Turan*

Abstract: Terrorism is serially growing in global, threat the security of world and rises the danger of bioterrorism. This mini review includes terror, terrorism and the potential danger or treat of bioterrorism. And also biological agents that could be sweated, last developments in novel technologies, detecting and/or controlling the biological treat. Terror; an event that been brought into action. Terrorism, on the other hand, describes the method has followed to realize the strategy or ideology of terrorism to achieve its religious, political or economic goals. The causes of terrorism are very diverse. For example it can be economic, psychological, ethnic, geopolitical and socio-cultural. The main types of terrorism; individual terrorism, supranational terrorism, biological terrorism, narco-terrorism, counter-state terrorism and global terrorism. Bioterrorism can be ideological, religious, political or economic gain by individuals, groups or governments and the use of biological agents cause disease or death among humanbeings, many animals and plants. Underlying purpose is to use biological pathogens, which have negative effects on people in particular and all living things in general, as biological weapons. For example, during World War II, Japanese forces tried various infectious diseases such as anthrax, plague and smallpox on prisoners in Manchuria and caused deaths. Today, proxy wars are taking place between terrorist structures and regular armies, and the use of biological agents as a weapon is a very strong possibility. Two concepts emerge here; biological warfare and bioterrorism. Attacks targeting military structures are considered “biological warfare”and attacks targeting civilians are considered “bioterrorism”.

Keywords: Terror, Terrorism, Bioterrorism, Biological Warfare

* Corresponding Author: Prof. Dr. Aybüke A. İsbir Turan, Turkish National Police Academy, Institute of Forensic Sciences, Necatibey Cad. Anıttepe, Çankaya, Ankara, Turkiye. E-mail: aybukeayse.turan@pa.edu.tr, aybuke.turan@gmail.com ORCID: 0000-0002-3650-7810

Adli Bilimler ve Suç Araştırmaları Dergisi

ISSN: 2687-3397
Yıl: 3, Cilt: 3, Sayı: 1-2, Aralık 2021 s.97-106 Makale Türü: İnceleme
Makalenin Geliş Tarihi: 04.11.2021 Makalenin Kabul Tarihi: 04.12.2021

Terörün Yeni Yüzü: Biyolojik Terör

Aybüke A. İsbir Turan

Öz: Küresel terörizm hızla büyüyen ve aynı zamanda dünya güvenliğine yönelik bir tehdittir ve biyoterörizm riskini artırmaktadır. Bu derlemede terör, terörizm ve potansiyel biyoterörizm tehdidi tartışılmaktadır. Ayrıca istismar edilebilecek ajanlar, teknolojilerdeki son gelişmeler ve kasıtlı olarak başlatılan biyolojik tehlikenin tespiti ve kontrolünü de ele alınmaktadır. Terör; eylem haline getirilmiş bir olay, terörizm ise terörün dini, siyasi veya ekonomik amaçlarına ulaşma stratejisini veya ideolojisini gerçekleştirmek için izlediği yöntemi anlatmaktadır. Terörizmin sebepleri etnik, psikolojik, kültürel, ekonomik, jeopolitik ve sosyal çevre olmak üzere çok çeşitli olabilir. Başlıca terör çeşitleri; bireysel terörizm, devlete karşı terörizm, ulusüstü terörizm, biyolojik terörizm, narko-terörizm, ve küresel terörizmdir. Biyoterörizm; kişiler, gruplar veya hükümetler tarafından ideolojik, dini, politik veya ekonomik kazanç sağlamak için insanlar, hayvanlar ve bitkiler arasında hastalığa ve/veya ölüme sebebiyet vermek amacıyla biyolojik ajanların kasıtlı olarak kullanılması veya kullanılma tehdididir. Temelinde yatan amaç; özelde insanların genelde ise tüm canlılarda olumsuz etkileri olan biyolojik patojenleri, biyolojik silah şeklinde kullanmaktır. Örneğin II. Dünya Savaşında Japon kuvvetleri, Mançurya'daki esirler üzerinde şarbon, veba ve çiçek gibi kolayca yayılabilen çeşitli enfeksiyon hastalıklarını deneyip ölümlerine neden olmuşlardır. Günümüzde terörist yapılar ile düzenli ordular arasında vekâlet savaşları yaşanmaktadır ve silah olarak da biyolojik ajanların kullanılması oldukça kuvvetli bir olasılıktır. Burada karşımıza iki tane kavram çıkmaktadır. Bu kavramlar; biyolojik savaş ve biyolojik terör yani biyoterörizmdir. Askeri yapılanmaları hedefleyen saldırılar "biyolojik savaş", sivil halkı hedefleyen saldırılar ise "biyoterörizm" olarak kabul edilmektedir. Biyoterör eylemlerinin sebepleri; politik, dinsel, fikirsel veya suç nedenli olabilir, kitlesel veya bireysel olarak planlanabilir veya terörist faaliyetlerin dahilinde olabilir.

Anahtar Kelimeler: Terör, Terörizm, Biyoterör, Biyolojik Savaş

Introduction

Bioterrorism in general goals are to form decrements, terror, societal degredation or an economical decrement, inspired by the spiritual, ideological or political convictions. It is achieved by the terrorist or terror groups, and also called non-state actors. In usual, terrorists want to achieve their aims through terror. Bioterrorism may cause these terrific activities. Forensic microbiology is a multidisciplinary branch of the research area and is related usual or standard sciences such as epidemiology, microbiology, forensic genetics, molecular biology and medicine (Amorim, 2010; Oliveria et al., 2018; Olievera et al., 2019).

Scientists working in the field of forensic microbiology achieve to detect, identify the origin of human beings life threatening biological agents as viruses, bacteria and toxins (Arenas et al., 2017). This area has some applications in a plurality of forensic social work scenarios those include bioterrorism (Budowle et al., 2003; Murch, 2003), biocrime (Dunley 2012; Shutzer et al., (2005), dishonest people (Allard et al., 2018, Araújo et al., 2017) transmission of pathogens (González-Candelas, 2017; Oliveira et al., 2018), or random extricate of pathogenic agent and/or toxin (di Pasquale et al., 2010, Knutsson et al., 2011).

Development and History of the Biological Treatment

Biological Warfare and Bioterrorism

Biological Warfare (BW) deals with deliberate use of the pathogenic agents like viruses, bacteria, fungi and toxins as biological weapons in combat events (Khar dori et al., 2005). Biological warfare can be more deadly than the other conventional weapons, as even the smallest amounts can cause many decrements and/or deaths that depend on the biological agent used (Atlas, 1999; Eitzen, 1997).

The intended uses of microorganisms or their toxins as biological weapons is as ancient as humankind itself. Examples have been reported from prehistorical and old Greek and Roman periods, for example the use of poisoned arrows, the contamination of water sources and the wells with the corpses and/or dead bodies. From early stages, biological weapons can turn into a weapon of massive demolition when partnered with a suitable surrender system as special materials for battlefield and confidential uses. These improvements are a direct outcome of the developments in both micro and biotechnology (Szinicz, 2005; Christopher et al, 1997). The historical evolution of biological weapons can be divided into three several ages. These are;

1. Prehistory-1900: Apart from a few well-documented cases, it is so difficult to explain whether biological weapon invasions were serious threats or a part of political deception as an outcome of the work of Robert Koch and Louis Pasteur, which resulted in the approval of the germ theory of the illness (Carus, 2017; Barras and Greub, 2014).

2. 1900 to 1945: This age is characterized by the occurrence of minor and uncomplicated national biological warfare programs. For example, in Japan, Germany, Soviet Union and USA the usage of biological weapons in both World Wars I and II (Carus, 2017; Barras and Greub, 2014; Tucker, 1999).
3. After 1945: Wide entrance to biological agents and progress in biotechnology and biochemistry authorized biological warfare programmes to be democratized and reachable to minor groups and individuals. During the age, the fatal potential of BW agents increased due to many advances with the researches of genetic engineers (Carus, 2017; Barras and Greub, 2014).

It is so difficult for microbiologists and historians alike to separate the natural epidemics from the biological attacks. For example the lack of confident scientific throughput on an professed bioterrorism attacks, particularly before coming of the modern microbiology, latent nature and polemical situations enclosure any biological attacks that is assumed to be open to many political falsifications and therefore it is difficult to comment objectively and chronologically from the earlier reports about these biological attacks and the possible misunderstandings when viewed through a contemporary lens (Barras and Greub, 2014; Beeching et al., 2002). Biological agents are deliberately delivered towards the civilian population (Khar dori et al., 2005). This effuse is motivated by ideology objectives like political or spiritual proposing to cause stampede, force decrements or economic loss (Jansen et al., 2014). Biological agents can be utilized as its natural form or modified genetically to develop massive emission with a higher mortality or more strength to currently usable medicine and vaccines (Pavlin, 1999). When the possibility of a bioterrorism invasion is very important to identify the agent included, it is not only to prevent panic among the population but also it is important to control the morbidity and mortality associated (Lehman (2014).

Biological Agents

Apart from the variation between forensic and epidemiological investigations in periods of protocols and objectives, it is necessary to search for sources of outbreaks and to separate the accidental and purposeful release of a particular pathogenic agent, due to the common goal of identifying the source of the microorganisms that are involved. Medical personnel should always be on the alert for eccentric, undefined or unexplained illnesses and symptoms. According to the Centers for Disease Control and Prevention, various diagnostic indicators may indicate an outbreak of infectious disease related to the deliberate release of pathogenic agents. Between them; an unusual mass of casual or geographic diseases, such as the people attending a public meeting, or patients with clinical symptoms indirect of an undeclared infectious disease epidemic (feverish illness, pneumonia, rash)

and an eccentric age distribution for extensive illnesses (for example, an increase in a pediatric disease between the adults). The deliberate delivery of a particular biological agent may create an overt or covered action. In the case of covered action, the version stays unnoticed and latent for days, weeks or even months. The first mark of the effuse is the appearance of the ill persons who can unconsciously infect the others. After that, an infected individual may ask for medical attention, and may be away from the existing area.

On the contrary, in the case of the open action, this release is quickly noticed and may even be declared. On the other hand, in open actions, public health officials, health and the communication systems are easily informed by the operators. Open action goals to cause extensive panic. Use of the biologic agents as biological weapons offers a lot of advantages over the more traditional weapons like the chemical weapons. These are microorganisms and relatively inexpensive, and can easily be produced in bulk. Huge quantities of biological agents can be easily hidden and transported in small bottles. Some other agents can be carried into different mediums like water or air, causing a diffuse in a short period of time and some of the biologic agents show person-to-person transfer (Seth, 1998).

Causes of Threats and Common Characteristics of Biological Weapons

Biological weapons have a wide variety of threats. Some of those; many varieties are available and easy to spread, variability of incubation times and potential for geographic dispersal during the incubation period, causing high death rates, storage problem due to short shelf life of important prophylactic (preventing disease) drugs/vaccine and difficulty quickly distinguishing between the bioterrorist inva sion and the natural rife.

The common features of biological weapons are as follows; permanent and increasing effect even at low concentrations, they are highly contagious and have a high potential for effect, have a brief and conjecturable incubation period, target population has usually little or no immunity to the relevant microorganism, ease of production and cheap cost, ease of use, difficult to identify and rare by the target population and potential to cause panic among the masses and collapse in the health system (Kortepeter and Parker, 1999).

Biological Terrorism: Bioterrorism

Today global terrorism shows a very quickly growing threat to the security of the world that rises the risk of the bioterrorism. Although threat of bioterrorism seems still further away from most industrialized and developing countries; In fact, while there are nations and opposition groups that can use biological agents as a tool in terrorist acts, risk of bioterrorism is alarming all over the World today. Bioterrorism acts can be political, religious, intellectual or criminal, planned by a group or individual, or be part of terrorist activities. While a bioterrorist inva-

sion is difficult to foretell, its consequences can be devastating and can never be ignored (Bronze et al., 2002).

Unlike biological warfare, in the bioterrorist invasion, biological agents are deliberately released against the civilian population (Khardori et al., 2005). This spread is motivated or justified by ideological goals aimed at causing panic, mass casualties or economic loss (Jansen et al. 2014). Biological agents can be used when they occur naturally, or they can be genetically modified to improve mass spread (for example, higher mortality or resistance to existing drugs and vaccines) (Pavlin, 1999). When faced with the possibility of a bioterrorist attack, identifying the agent of interest is crucial not only to prevent panic in the population, but also to the control of the morbidity and the mortality associated with the extended of the agent (Lehman, 2014).

Feature of the biological agents, which differs from many agents, is their ability to multiply in the body over time and increase their effect gradually. For this reason, biological weapons cause a very high level of damage. Compliance with environmental conditions; It causes the effects of biological agents to increase exponentially and to be permanent in their environment. Large number of biological warfare agents are presented in the literature. The potential bioterrorism agents and the conditions they are associated with are given below under the main headings of bacteria, viruses and toxins. Bacteria; Clostridium botulinum (botulism), Bacillus anthracis (anthrax), Burkholderia pseudomallei (melioidosis), Brucella species (brucellosis), Coxiella burnetii (Q fever), Burkholderia mallei (glands), Escherichia coli (hemolytic uremic syndrome), Francisella tularensis (tularaemia), Salmonella species (salmonellosis), Salmonella typhi (typhoid fever), Shigella species (shigellosis), Vibrio cholera (cholera), Yersinia pestis (plague). Viruses; Variola major (Smallpox), Ebola virus (Ebola virus hemorrhagic fever), Lassa virus (Lassa fever), Arenaviruses (Junin and Lassa fever), Marburg virus (Marburg virus hemorrhagic fever). Toxins; Rising toxin from Ricinus, Botulinum toxin (botulism) (Murch, 2015; Murch, 2014).

Bioterrorism and Biosecurity

One of the examples of bioterrorism in the world is in Autumn of 2001; the invasion occurred with letters carrying the anthrax spores in the United States. This event can be considered as one of the first harbingers of bioterrorism. Although the threat posed by biological agents to public health has been known since the discovery of these agents and they have been used as a means of war since ancient times, they attracted the attention of the medical community and the public (Seth, 1998).

In cases thought to be a bioterrorist attack, drawing attention to the following questions will play an important role in mitigating or eliminating crises that may occur or may occur; “What was the pathogenic microbial agent?”, “Where did it come from?”, ”Where are native reservoirs located in?”, “What are the possible

transmission routes?", "Are there any transporters?", "Which possible targets are touched?", "How did microorganisms improve?", "Are there any toxins concerned?, "Which antibiotics are microorganisms responsive or robust to?", "Has the microorganism been modified genetically or chemically to improve its virulence or distribution ability?".

Legally, it goals to define who is responsible for acts of the interest (biological warfare, bioterrorism) or who is else accused, with respect to the guidelines identified and applied within a legal regime (Keim et al, 2011; Khan et al, 2020; Karwa et al., 2005). Another key factor to consider is sample collection and storage to maximize recovery of microorganisms and preserve sample integrity as the total work relies on proper and effective sampling procedures. The verification of results is an important factor and it is possible to use evidence like this to explain the facts in a law court, to determine whether a crime has been committed. To adapt the existing rules for inspecting a crime scene to a combination of experts' prior knowledge, research expertise, and common sense.

The worth of evidence when attentively assembled and stored, can be lost if the chain of observation is not fairly established. The chain of observation is often regarded as the weakest link in criminal research. It refers to the technique for the chronological documentation of the evidence that links it to a criminal fault. From beginning to end of a forensic process, it is necessary to indicate and document every step to ensure evidence "tracking" and "integrity" from crime arena to courtroom. The collection of samples should be done very carefully by qualified technicians using the appropriate equipment like clothes, gloves and masks to minimize the sample contamination and to prevent the threat of infections. Samples should be accompanied by a registry of who collected under which conditions and the methods that are used during the collection of them, where and how the samples were stored like temperature, relative and humidity and who accessed and managed any scientific work on the samples (Arenas et al., 2017; Olievera et al., 2019).

Conclusions

Terrorists frequently see pathogenic agents like bacteria, bacterial toxin or vi rus as a more attractive and alternative to the use of the conventional weapons. Biological weapons output is associated with very low charge or price, micro organisms are very reachable, can be simple to manufacture and deliver while avoiding any invention, and even the danger or the risk of their usage can easily cause anxiety between people and widespread communal corruption. The extrication of a biological weapon aims to cause disease and even deaths. These are inherently consisting microorganisms, but sometimes they can be engineered to be more deleterious rising their capacity to cause or effuse illness or to resist known therapeutic touches.

This mini review shows that biological crime and bioterrorism is a historical fact and has existed almost from the beginning of time.

Therefore, the right question to ask is not whether another attack will be made using biological agents as weapons, but it can be when the next attack or invasion will be using biological agents as weapons. So, it is critical to plan for a well-timed and powerful answer to the release and spread of a biological agent, implying a reliable and instructive classification of the agent(s) used. Controlled access to the data on global collections of acting strains, the scientists study to characterize less well-studied and more difficult to culture biological agents, will aid this effort. Preventive and urgent detection or measures such as comprehensive environmental monitoring should also be implemented.

It is important to highlight the scope of capabilities of microbial forensics as well as managing the expectations of law administration agencies, policy makers, the general public and the scientific community. In that case, how should security be ensured in bioterrorism activities, which are considered as a possible danger at any time? This concept, which is defined as biosecurity, covers the risk management processes and the determination of the negative effects it may have on biological diversity with modern biological techniques and applications. For long-term solutions, the medical community should educate the public and policy makers about bioterrorism and immediately build a global consensus. Therefore, it would be appropriate to give some key messages. These are being prepared for deliberate outbreaks will strengthen the response to natural outbreaks, outbreaks must be sustained with high-level leadership, responsibility and authority. The healthcare industry should consider the potential for bioterrorism and the existence of unknown pathogens and maintain awareness of biological agents. Emergency services and physicians should be regularly updated about the clinical manifestations of diseases caused by possible bioterrorism agents and emerging infectious illnesses. Personal protective equipment should be developed to rapidly equip the health system to deal with these problems for cases of sudden and large increases in patients with serious, contagious diseases. Capacity of general and reference laboratories should be increased to develop faster, more reliable diagnostic tests, novel and advanced vaccines and treatment regimens have to be developed. By developing syndromic surveillance systems, for example the systems of systematic observation of how certain diseases arise and spread, cases and data reported by physicians can be used to improve risk communication and follow the progress of an epidemic, sufficient stocks of vaccines and medicines should be kept in both national and international contexts, to improve preparedness for inherent and bioterrorist outbreaks, systems of remediation and management should be established for international cooperation, joint multi-country exercises, and continuous exchange of the information on potential bioterrorism risks.

References

Allard M.W., Bell R., Ferreira C.M., Gonzalez-Escalona N., Hoffmann M., Muruvanda T., Ottesen A., Ramachandran P., Reed E., Sharma S. (2018). Genomics of Foodborne Pathogens for Microbial Food Safety, Curr. Opin. Biotechnol. 49, pp. 224–229.

Amorim A. (2010). Introduction to the Special issue on forensic genetics: non-human DNA (Guest Editor: Antonio Amorim), *Open Forensic Sci. J.*, pp. 3.

Araújo R., Pereira F., Asch Bv. (2017). Applications of DNA-Based Methods in Food Forensics, Handbook Of Forensic Genetics: Biodiversity And Heredity n Civil And Criminal Investigation, pp. 493–517.

Arenas, M., Pereira, F., Oliveira, M., Pinto, N., Lopes, A.M., Gomes, V., Carracedo, Amorim, A. (2017). Forensic genetics and genomics: much more than just a human affair, PLoS Genet. 13, e1006960.

Atlas, R. M.(1999). Combating the threat of biowarfare and bioterrorism: defending against biological weapons is critical to global security, *BioScience*, 49, pp. 465-477.

Barras, V., Greub, G. (2014). History of biological warfare and bioterrorism, *Clin. Microbiol. Infect.*, 20, pp. 497-502.

Beeching, N.J., Dance, D.A., Miller, A.R., Spencer, R.C. (2002). Biological warfare and bioterrorism, *BMJ 324*, pp. 336–339.

Bronze M.S., Huycke M.M., Machado L.J., Voskuhl G.W., Greenfıeld R.A. (2002). Viral agents as biological weapons and agents of bioterrorism, *the American Journal of The Medical Sciences*, 323, 6, pp. 316-325.

Budowle B., Schutzer S.E., Einseln A., Kelley L.C., Walsh A.C., Smith J.A., Marrone B.L., Robertson J., Campos J. (2002). Building microbial forensics as a response to bioterrorism, *American Association for the Advancement of Science*, 2003, 301, 5641, pp. 1852-1853.

Carus, W.S. (2017). A Short History of Biological Warfare: From Pre-history to the 21st Century Government Printing Office

Christopher, L.G.W., Cieslak, L.T.J., Pavlin, J.A., Eitzen, E.M. (1997). Biological warfare: a historical perspective, JAMA, 278, pp. 412-417.

Danley L. (2012). Duties and difficulties of ınvestigating and prosecuting biocrimes, *J. Biosecur. Biosaf. Biodefense Law*, 3.

Di Pasquale S., Paniconi M., Auricchio B., Orefice L., Schultz A.C., De Medici D. (2010). Comparison of different concentration methods for the detection of hepatitis a virus and calicivirus from bottled natural mineral waters, *J. Virol. Methods* 165, pp. 57–63.

Eitzen, E.M. (1997). Use of biological weapons, Medical Aspects of Chemical and Biological Warfare, pp. 437-450.

González-Candelas F. (2017). Molecular epidemiology and evolution concepts in microbial forensics, Handbook of Forensic Genetics: Biodiversity and Heredity in Civil and Criminal Investigation, World Scientific, pp. 561–582.

Jansen, H.-J., Breeveld, F.J., Stijnis, C. , Grobuschm, M.P. (2014). Biological warfare, bioterrorism, and biocrime Clin. Microbiol. Infect., 20, pp. 488-496

Karwa M., Currie B., Kvetan V. (2005). Bioterrorism: preparing for the ımpossible or the ımprobable, *Crit. Care Med*. 33, 1, pp.S75-S95.

Keim, P.S. , Budowle, B., Ravel, J. (2011).Microbial forensic investigation of the anthrax-letter attacks, *Microbial Forensics*, *Elsevier*, pp. 15–25.

Khan, A.S., Amara, P.S., Morse, S.A. (2020). Forensic public health: epidemiological and microbiological investigations for biosecurity, *Microbial Forensics*, Elsevier, pp. 105–122.

Khardori, N., Kanchanapoom, T. (2005). Overview of biological terrorism: potential agents and preparedness, *Clin. Microbiol. Newsl*., 27, pp. 1-8

Knutsson R., Van Rotterdam Fach B.P., De Medici D., Fricker M., Löfström C., Ågren J., Segerman B., Andersson G., Wielinga P. (2011). Accidental and deliberate microbiological contamination in the feed and food chains—how biotrace-ability may improve the response to bioterrorism, Int. J. Food Microbiol. 145, pp. 123–128.

Kortepeter M.G. and Parker G.W.(1999). Potential biological weapons threats, emerging ınfectious diseases, Vol. 5, No. 4, pp. 523-527.

Lehman, D.C. (2014). Forensic microbiology Clin. Microbiol. Newsl., 36, pp. 49-54.

Murch R.S. (2015). Bioattribution needs a coherent international approach to improve global biosecurity, *Front. Bioeng. Biotechnol*. 3, p. 80.

Murch R.S. (2014). Designing an effective microbial forensics program for law enforcement and national security purposes, *Arch. Immunol. Ther. Exp*. 62, pp. 179–185.

Murch R.S. (2003). Microbial Forensics: Building a National Capacity to Investigate Bioterrorism, Biosecur. Bioterror. 1, pp.117–122.

Oliveira M., Amorim A. (2018a). Microbial forensics: new breakthroughs and future prospects, *Appl. Microbiol. Biotechnol*. 102, pp. 10377–10391.

Oliveira M., Arenas M., António A. (2018b). New trends in microbial epidemiology: can an old dog learn new tricks?, *Ann. Microbiol. Immunol*. 1, pp. 1–7.

Pavlin, J.A. (1999). Epidemiology of bioterrorismm, *Emerg. Infect. Dis*., 5, p. 528

Schutzer S.E., Budowle B., Atlas R.M. (2005). Biocrimes, microbial forensics and the physician, *PLoS Med.* 2, p. e337.

Seth C. W. (2008). Bioterrorism and Biocrimes, Chapter 2, pp. 42-96.

Szinicz, L. (2005). History of chemical and biological warfare agents, Toxicology, 214, pp. 167-181.

Tucker J.B. (1999). Historical trends related to bioterrorism: an empirical analysis, emerging ınfectious diseases, Vol. 5, No. 4, pp. 498-504.