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Role of Microbiology in Present World

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Review Article

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ABSTRACT

Microbiology is a branch of medical science which plays vital role in present world. Microbiology can be regarded as study of microorganisms. There are different types of microbes like bacteria, algae, fungi, protozoa, viruses, etc.). Both beneficial and harmful effects of different microorganisms have listed in this review.

INTRODUCTION

Microbiology is the study of microorganisms, which can be observed only under microscope. There are various types of microbes (like bacteria, fungi, algae, protozoa, viruses, etc.) which are generally playing their vital role causing diseases. Microbes can live in every part of biosphere including soil, ocean floor, atmosphere, hot springs, Earth's crust, etc. hence called ubiquitous. Antonie van Leeuwenhoek, a man who

observed the presence of microbes for the first time by using his magnifying lens, has been considering as "Father of Microbiology" and another scientist named Louis Pasteur who has given a lot of contributions to this field of Microbiology has been considering as "Father of Modern Microbiology" [1,2].

The field of Microbiology is having a lot of significance in daily human life as it generally deals with different types of diseases caused by different types of microbes and also with remaining ingredients of living organisms (like blood cells, antibiotics, antibodies, etc.). Microbes are having both beneficial and harmful effects. In general, Growth of microorganisms can be determined by measuring the diameter of inhibition zone [1,2].

There are few microbes playing major role in causing diseases and some other microbes are playing role in producing antibiotics. These antibiotics generally inhibit the activity of the toxin produced by pathogen [3]. Antimicrobial agent usage is very common in animal agriculture for prophylactic and treatment purposes [4]. Antimicrobial Photodynamic Therapy has been proposed as an excellent treatment for a large variety of localized microbial infections [5]. Antibiotic susceptibility profiles of microbes vary from hospital to hospital/ town to town/ country to country and sometimes in the same town as well as the facilities between public and private healthcare in the same area [6].

Microbes generally grow in an environment of high moisture contents and nutrients [7]. There are many diseases caused by microbes and some of the microbial diseases include amoebiasis, tuberculosis, leprosy, cholera, anthrax, typhoid, AIDS, measles, rabies, candidiasis, small pox, botulism, influenza, diphtheria, meningitis, mumps, pneumonia, polio, whooping cough, etc.

Amoebiasis is a well-known diarrheal infection caused by parasitic anaerobic protozoan called *Entamoeba histolytica* [8]. The main cause of acute diarrhea (gastroenterological infection) which occurs often in childhood is dehydration. It can be diagnosed with the presence of more than three watery stools a day lasting for 7-14 days. Amoebiasis generally causes bacterial, viral, alimentary intoxications and gastrointestinal infections in primary stage [9]. Cutaneous Acanthamoebiasis is an infrequent infection in immune compromised patients which need to be diagnose in advance as it can disseminate to the central nervous system and may cause granulomatous amoebic encephalitis, which is fatal [10].

Tuberculosis is a deadly infectious disease which can transmit through respiratory tract in the form of aerosol droplets particularly in upper part of respiratory system. *Mycobacterium tuberculosis* is the causative agent of tuberculosis which lives longer than most other bacteria and affects all age groups. It has associated with significant mortality and remains one of the top ten leading causes of death [11-24].

Leprosy is an infectious disease which can be otherwise called Hansen's disease. *Mycobacterium leprae* and *Mycobacterium lepromatosis* are the main two causative agents of leprosy disease. Factors, symptoms, diagnosis, transmission, Immunology and treatment of leprosy disease have been explained through several leprosy articles [25-37].

Vibrio cholerae is the causative agent of cholera disease which remains a major health problem due to poor sanitation and unhygienic conditions [38-41]. Cholera remains a most dangerous food and water born disease and an acute watery diarrheal infection in childhood. *V. cholerae*, a gram-negative pathogen (which can be found mostly in soil, water, other host organisms, etc.) is the causative agent of cholera disease. It is an opportunistic and multidrug-resistant pathogen which will cause nosocomial infections. It will also cause of chronic lung infections in patients with the disease of cystic fibrosis [42,43]. *V. cholerae* is having more than 180 serogroups and responsible for approximately three to five million cases per annum. Cholera remains a major public health problem [44,45] with symptomatic infections like vomiting, acute watery diarrhoea which can rapidly lead to death due to dehydration if not treated immediately [46]. Poor hygiene conditions are largely responsible for this cholera disease [47]. Antibiotics need to give immediately along with aggressive hydration [48].

A rod-shaped, gram-positive bacterium called *Bacillus anthracis* is playing major role in causing Anthrax disease [47-49]. A non-spore forming gram negative facultative anaerobic rod shaped bacterium called *Salmonella Typhi* is the causative agent of Typhoid fever which is a water and food borne microbial infection [50,51]. It is one of the most serious forms of enteric fever with more prevalence in developing countries because of unhygienic conditions and poor antibiotic resistance [52,53]. Typhoid fever is an important cause of morbidity which can be diagnosed with culture techniques, molecular and serology techniques, etc. [54,55]. Typhoid free society may appear with general preventive methods like improved sanitation methods and clean water supplies [56].

HIV is the causative agent of Acquired immune deficiency syndrome which generally affects host immune system [57]. The impact of HIV remains a significant health care challenge that affects families, communities and health care systems [58]. CD4 cells of immune system are the primary target of HIV which will ultimately leads to AIDS [59]. HIV virus will never transmit through Oral cavity with some exceptional cases like breastfeeding and oral sex [60].

Measles is a contagious infection caused by *Measles virus* is a causative agent of a contagious infection called Measles. It is an enveloped RNA virus generally spreads through respiratory tract with symptoms like fever, skin eruption, etc. [61-69].

Rabies is a zoonotic viral infectious disease which generally causes acute encephalitis to humans and other animal species. *Lyssa virus* is the causative agent of rabies disease and which is having single-stranded negative-sense RNA virus as genetic material. Although various types of anti-rabies vaccines are available, vaccination against rabies disease is unique [70-75].

Various types of fungal candida species are playing major role in causing Candidiasis. It is the most common fungal disease which affects mucosa, skin, nails and also few internal organs of children [76]. Chronic Disseminated Candidiasis is one of the different forms of Candida infection, in which involvement

of the spleen, liver and kidneys occurs in rare cases [77]. *Candida albicans* is a fungal species which can proliferate and cause a serious of infections that are almost life-threatening in case of low immune resistance [78].

Influenza virus is the causative agent of respiratory infectious disease called Influenza. It is a single-stranded, negative-sense RNA virus belonging to the family Orthomyxoviridae. Birds and Mammals are acting as major reservoirs of newly emerging influenza viruses and the most effective method to prevent influenza is immunization process [79-83].

Corynebacterium diphtheriae is the causative agent of an infectious disease Diphtheria. It is a pathogenic rod shaped bacterium [84]. Trivalent combination vaccines against pertussis, tetanus and diphtheria infections have been using widely since 1940s in immunization process [85,86].

Meningitis is an inflammatory response of cerebrospinal fluid to microbial infection (bacterial, viral) [87]. Most pathogenic microbes are able to cause meningitis in humans. However, few bacteria like *Haemophilus influenzae*, *Neisseria meningitides* and *Streptococcus pneumoniae* are the most common microbes to cause bacterial meningitis [88].

Mumps is a most common viral infection in childhood, which can generally recognize by the enlargement of salivary glands [89,90]. It belongs to the family *Paramyxoviridae* and having an incubation period of 2-4 weeks. Neurological complications are the most regular manifestations which will start developing within a week. Some of the symptoms of Mumps virus include deafness, facial neuritis, encephalitis, cerebellar ataxia, hydrocephalus, polyradiculitis and transverse myelitis [91].

Streptococcus pneumoniae is a major pathogen that can cause infection in childhood. We are losing almost one million people every year because of the infection of Streptococcus pneumonia. Drug resistant Streptococcus pneumoniae is widely distributed around the world and increasing its prevalance [92,93].

Polio is a viral infection which can be otherwise called infantile paralysis. It is a subgroup of family picornavirdae with three major serotypes PV1, PV2 and PV3. This virus generally transmitted through oral discharge from oral routes. Virus multiplies in the oral larynx and small intestine after entering human body. It usually attacks local lymphoid tissues and then enters into the main blood system, at the time of nervous system attack [94].

Clostridium botulinum bacteria generally causes a Food borne disease called Botulism [95]. Intentional or accidental exposure to botulinum toxins may lead to botulism [96]. A non-invasive pathogen *Bordetella pertussis* generally causes a respiratory infection called Whooping cough (pertussis), accounts for more than three lakh deaths per year. *B. pertussis* develops mainly in the upper respiratory system and produces a large number of virulence factors, many of which play vital role in causing disease [97-101].

DISCUSSION

Microbiology deals with both beneficial and harm full effects of microbes equally for the betterment of human population. Microbes which are beneficial for human population are playing vital role in both food and pharmaceutical industry in the form of fermentation technology, Antibiotics, etc. There are certain microorganisms which will cause harmful effects and these can be regarded as pathogens.

CONCLUSION

Microorganisms may act as antigens (harmful effect) but, the same microorganisms are producing antibiotics too (Beneficial effect). Microbes may spoil food materials (harmful) but the same microbes are playing vital role in fermentation industry (Beneficial). Role of Microbiology has been increasing day by day as there are significant discoveries in recent years in almost all the fields of microbiology like food microbiology, agricultural microbiology, medical microbiology, etc. It has become the part of human life in present world with its significance and day by day discoveries.

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