aurum

JOURNAL OF HEALTH SCIENCES
A. J. Health Sci.

Volume 2 Supplement 1/ 2020, 61-65

Review

The Importance of Antimicrobials in the Public Health

H. Halil Biyik[1], Burçak Yavuz[2]

[1]Department of Biology, Faculty of Science and Arts, Aydın Adnan Menderes University, Aydın, Turkey
[2]Electroneurophysiology Program, Vocational School of Health Services, Altinbas University, Istanbul, Turkey

Abstract: As in the past, today, antimicrobial products remain important in public health. Antimicrobial products used to protect against epidemic during the pandemic attracted the attention of the public. Antimicrobial agents stops or decelerates the spread of microorganisms. Microorganisms include bacteria, viruses, protozoans, and fungi. Increasing the effectiveness of antimicrobial products against microorganisms is very important today. Antimicrobial products we can see in every area of our daily life in house, workplace, or at school. In this review, we aimed to give brief information under the headings impact mechanisms of antimicrobials, production sources of antimicrobials new generation antimicrobials; what is safe antimicrobial in public health?

Keywords: *Antimicrobials; antifungal; antibacterial; antiviral*

Address of Correspondence: H. Halil Biyik- h.biyik@adu.edu.tr 0000-0003-0258-054X, Department of Biology, Faculty of Science and Arts, Adnan Menderes University, Aytepe Local, Efeler, Aydın, Turkey. Burçak Yavuz 0000-0002-3555-4850

1. Introduction

Antimicrobials are defined as substances that have the power to reduce the presence of microorganisms or kill them completely. Antimicrobials can be classified according to their functions and the organism it acts on. Antibiotics that prevent the reproduction of bacteria are one of our most particularly weapon in fighting bacterial infections (Törün et al., 2017). Coronavirus-19 (Covid-19) appeared in Wuhan, China in December 2019 and with the announcement of this pandemic, the importance of antimicrobials became even more understandable. The use of antimicrobial effective disinfectants and antiseptics has increased rapidly today.

Antimicrobial drugs can be grouped based on the microorganisms to which they are effective. For example, antibiotics against bacteria and antifungals against fungi are used. They can also be classified

according to their functions. Agents that kill microorganisms are called microbicide, and only agents that inhibit their growth are called biostatic (Antimicrobial; https://en.wikipedia.org/wiki/Antimicrobial accessed; 30.06.2020). Microbicides are used for the purpose of microorganisms such as viruses or bacteria. Biocide is define intended to destroy, deter, render harmless, or exert a controlling effect on any harmful organism. Any biocidal compound that is to reduce its infectivity or substance. We can give wood tar as an example. The use of antimicrobial drugs to treat infection is called Antimicrobial Chemotherapy. Antimicrobial Chemotherapy can be classified as Antibacterial Chemotherapy Antifungal Chemotherapy Antihelminthic Chemotherapy Antiprotozoal Chemotherapy Antiviral Chemotherapy. Also, the use of antimicrobial drugs to prevent infection is called Antimicrobial Prophylaxis. (Antimicrobial; https://en.wikipedia.org/wiki/Antimicrobial accessed; 30.06.2020).

1.2. *Antibacterials*

Bacterial infections are among the important infectious diseases. Hence, over 60 years of extensive researches have been launched for achieving new antimicrobial medicines isolated from different sources. Despite progress in development of antibacterial agents, there are still special needs to find new antibacterial agents due to development of multidrug resistant bacteria (Moghadamtousi et al., 2014)

1.3. *Antivirals*

Lack of effective therapeutics for the most of viral diseases, emergence of antiviral drug resistance, and high cost of some antiviral therapies necessitate finding new effective antiviral compounds (Lemoine et al., 2013; Moghadamtousi et al., 2014; Tomei et al., 2005) Antiviral drugs are a class of medication used specifically for treating viral infections. Like antibiotics, specific antivirals are used for specific viruses.

1.4. *Antifungal*

Antifungals are used to kill or prevent growth of fungi. Fungal and human cells are similar at the molecular level, making it more difficult to find a target for an antifungal drug to attack that does not also exist in the host organism. In addition to their use in medicine, antifungals are often preferred to control fungal growth in humid or wet places, especially indoors. Sodium bicarbonate (baking soda) blasted on to surfaces acts as an antifungal.

2. Non-Pharmaceutical Antimicrobials

A wide variety of chemical and natural compounds are used as antimicrobials, organic acids and salts; lactic acid, citric acid, acetic acid are used in food either as food additives or as disinfectants. For example, acids are usually sprayed on the beef carcasses, and then washed or steamed to reduce the amonunt of *Escherichia coli*. Copper alloy surfaces have antimicrobial properties due to their natural structure and can kill microorganisms such as *E. coli* and *Staphylococcus.* In addition to regular cleaning, antimicrobial copper alloys are installed in some health facilities and metro transit systems. Other heavy metal cations such as Hg^{2+} and Pb^{2+} (cive and lead ions) have antimicrobial activities, but they may be toxic. Also it is known

that laurel, ceramic, carnation and thyme oils are most effective against food-borne bacterial pathogens. Its active ingredients are generally terpenoids and secondary metabolites. Many of these agents appear to have different structures and modes of action than antibiotics in use, that detection the concern that cross-resistance may be minimum with the agents currently in use. The resistance of a bacterium that has lost its sensitivity to an antibiotic against other antibiotics with similar chemical structure or similar mechanism of action is called cross-resistance.

3. Classification of Antimicrobial Agents

The efficiency of an antiseptic must be measured in relation to three main factors: concentration, time, and temperature. It is desirable to know the minimum concentration at which an antiseptic will be effective. Some antiseptics such as phenol lose their antiseptic activity after a certain dilution, whereas mercurial preparations still inhibit bacterial growth at very high dilutions. Most antiseptics act faster under increased temperatures; the activity of coal-tar derivatives, for instance, is doubled by a rise in temperature from that of a cool room to body heat. Many antiseptics destroy certain types of microorganisms and not others. Many others will kill bacteria but not their spores, which are walled, usually dormant, reproductive bodies. Alcohols are among the most widely used antiseptics, especially ethyl and isopropyl alcohol, which are commonly used in a 70% concentration in water. They are also widely used in combination with other antiseptic agents. The phenols contain a large number of common antiseptics and disinfectants, among them phenol (carbolic acid) and creosote, while such bisphenols as hexyl resorcinol and hexachlorophene are widely used as antiseptic agents in soaps. Chlorine and iodine are both extremely effective agents and can be used in high dilution. The quaternary ammonium compounds are more widely used as disinfectants than as antiseptics. Certain acridine dyes are used as antiseptics, as are some aromatic, or essential, oils (Antimicrobial Agent, https://www.britannica.com/science/antimicrobial-agent Accessed; 30.06.2020)

4. New Generation Antimicrobials

It includes the development of small molecule libraries customized for bacterial targets, as well as by applying metagenomics to increase the number of isolations from various media or to identify bioactive compounds produced by microorganisms that are currently unknown and not cultured. Recently, many bacterial species, fungi, algae and plants are employed to produce clean, nontoxic, biocompatible and environmentally friendly silver nanoparticles (SNPs). The advantage of biogenic SNPs are that the molecule can be coated with proteins (secreted by microorganisms such as fungi) allowing them more stable in the aqueous solutions (Korani et al., 2015). Nanomaterials today are a promising platform for alternative measures to control bacterial infections as they offer prolonged antimicrobial activity with negligible toxicity, compared with small molecular antimicrobial agents that display short-term activity and environmental toxicity. The antimicrobial nanoparticle physically destroys cell membranes of the organism which prevent development of drug-resistance microbes (Farouk at al., 2018). Usually, after a unique pioneering natural product is discovered, modifications are made on the molecule to increase the existing activity or to obtain new activities. By using chemical synthesis reactions, biotransformation, combinatorial biosynthesis or a combination of these techniques, high quality molecule libraries can be created for drug discovery studies (Güner et al., 2019).

5. Aydin Adnan Menderes University Department of Biology and Antimicrobials

Aydın Adnan Menderes University, Biology Department, Microbiology Science has been working on classical and new generation antimicrobial activities for the last fifteen years. (Biyik et al., 2018; Çoban et al., 2017; Çoban et al., 2018; Torun et al., 2018). We investigate the effects of chemically synthesized (BOR) "Vic-dioxime derivatives and metal complexes, heteroaromatic hydrozone groups and metal complexes, methylbenzohydrazide and metal complexes, thiosemicarbazone glyoxime and metal complexes, hydrazone-oxime ligands and metal complexes, imidazole salts and derivatives, gipsimogenin derivatives complexes, 1,2 Diboran compounds and derivatives on clinically important bacteria, yeast and microfungi (ADÜ-BAP-2020).

Conflict of Interest

No conflict of interest is declared by the authors.

References

Antimicrobial, www.wikipedia.com (accessed 30 June 2020)

Antimicrobial agent, https://www.britannica.com/science/antimicrobial-agent, (accessed 30 June 2020)

Biyik, H. H., Torun, B., Onur, M., Coban, E. P. (2018). Effects of the stem extracts of *Cynara scolymus* L. on some microorganisms. Annals Of Phytomedicine-An International Journal, 7(2), 138-142

Coban, E. P., Ercin, Z., Torun, B., Biyik, H. H. (2018). Antimicrobial effects of the stem extracts of *Apium graveolens* Mill. Annals of Phytomedicine-An International Journal, 7(2), 70-75.

Coban, E. P., Fırıncı, R., Biyik, H., Günay, M. E. (2017). Unsymmetrically substituted imidazolium salts: synthesis, characterization and antimicrobial activity. Brazilian Journal of Pharmaceutical Sciences, 53(1).

Farouk, S. N., Muhammadi A., Aminu, M. A. (2018). Application of nanomaterials as antimicrobial agents: a review. Arch Nano Op Acc J, 1(3). ANOAJ.MS.ID.000114. Doi: 10.32474/ANOAJ.2018.01.000114.

Güner, E., Yılmaz, S., Yusufoğlu, Kırmızıbayrak P.B., Bedir, E. (2019) Microbial transformation of cycloastragenol and astragenol by endophytic fungi isolated from Astragalus species." Journal of Natural Products 82, 11, 2979-2985.

Korani, M., Ghazizadeh, E., Korani, S., Hami, Z., Mohammadi-Bardbori, A. (2015). Effects of silver nanoparticles on human health. European Journal of Nanomedicine, 7(1), 51-62.

Lemoine, M., Nayagam, S., Thursz, M. (2013). Viral hepatitis in resource-limited countries and access to antiviral therapies: current and future challenges. Future Virology, 8(4), 371–380.

Moghadamtousi, S. Z., Kadir, A. H., Hassandarvish, P., Tajik, H., Abubakar, S., Zand, S., A. (2014). Review on antibacterial, antiviral, and antifungal activity of curcumin. Hindawi Publishing Corporation BioMed Research International, Article ID 186864, 12 http://dx.doi.org/10.1155/2014/186864

Tomei, L., Altamura, S., Paonessa, G., De Francesco, R., Migliaccio, G. (2005). HCV antiviral resistance: the impact of *in vitro* studies on the development of antiviral agents targeting the viral NS5B polymerase. Antiviral Chemistry & Chemotherapy, 16(4), 225–245.

Torun, B., Çoban, E. P., Biyik, H. H., Barisik, E. (2017). Antimicrobial Activity of *Echinophora tenuifolia* L. and *Raphanus sativus* L. Extracts. Indian J Pharm. Education Research, 51(1),136-43.

Torun, B., Biyik, H. H., Ercin, Z., Coban, E. P. (2018). Antifungal activities of *Urtica dioica* L., *Sinapis arvensis* L. and *Apium graveolens* Mill. leaves on *Botrytis cinerea* Pers. Annals of Phytomedicine, 7(2), 94-97.