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REVIEW ARTICLE

Clinical Applications of Antimicrobial Peptides (AMPs): Where do we Stand Now?

Divyashree M.[1], Madhu K. Mani[1], Dhanasekhar Reddy[2], Ranjith Kumavath[2*], Preetam Ghosh[3], Vasco Azevedo[4] and Debmalya Barh[1,5*]

[1]Nitte University Centre for Science Education & Research (NUCSER), NITTE (Deemed to be University), Paneer campus, Deralakatte, Mangalore – 575018, Karnataka, India; [2]Department of Genomic Science, School of Biological Sciences, Central University of Kerala, Tejaswini Hills, Periya (P.O) Kasaragod, Kerala-671316, India; [3]Department of Computer Science, Virginia Commonwealth University, Richmond, VA 23284, USA; [4]Laboratório de GenéticaCelular e Molecular, Programa de Pós-graduaçãoemBioinformática, Instituto de CiênciasBiológicas (ICB), Universidade Federal de Minas Gerais, Av. Antonio Carlos 6627, Pampulha, Belo Horizonte, CEP 31270-901, Brazil; [5]Centre for Genomics and Applied Gene Technology, Institute of Integrative Omics and Applied Biotechnology (IIOAB), Nonakuri, PurbaMedinipur, West Bengal, India

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Abstract: In this era of multi-drug resistance (MDR), antimicrobial peptides (AMPs) are one of the most promising classes of potential drug candidates to combat communicable as well as non-communicable diseases such as cancers and diabetes. AMPs show a wide spectrum of biological activities which include antiviral, antifungal, anti-mitogenic, anticancer, and anti-inflammatory properties. Apart from these prospective therapeutic potentials, the AMPs can act as food preservatives and immune modulators. Therefore, AMPs have the potential to replace conventional drugs and may gain a significant global drug market share. Although several AMPs have shown therapeutic potential *in vitro* or *in vivo*, in most cases they have failed the clinical trial owing to various issues. In this review, we discuss in brief (i) molecular mechanisms of AMPs in various diseases, (ii) importance of AMPs in pharmaceutical industries, (iii) the challenges in using AMPs as therapeutics and how to overcome, (iv) Available AMP therapeutics in market, and (v) AMPs under clinical trials. Here, we specifically focus on the therapeutic AMPs in the areas of dermatology, surgery, oncology and metabolic diseases.

Keywords: Antimicrobial peptides (AMPs), clinical trial, mechanism of action, drug development, pharmaceutical importance, immune modulators.

1. INTRODUCTION

Antimicrobial peptides (AMPs), also known as host defence peptides, are the essential part of the innate immunity and are evolved to combat microbial challenges in most living organisms over 2.6 billion years [1]. Generally, AMPs are positively charged with short chains of amino acid monomers and found virtually in all the life forms from microorganisms to humans, and they display remarkable structural and functional diversity [2-3]. In nature AMPs are synthesized in two ways: by ribosomal translation of mRNA or non-ribosomal synthesis. Ribosomally synthesized AMPs are produced by all species of life forms and are genetically encoded, while non-ribosomally synthesized peptides are mainly produced by bacteria [4]. The peptides from the non-ribosomal origin have been using as antibiotics for several decades; recently more importance is given to ribosomally synthesized peptides for their therapeutic potential [4-5].

2. AMPs AND THEIR MODE OF ACTIONS

The focus on the structure and functions of antimicrobial peptides has increased in recent years. AMPs have marked variations in the length, structure and sequences. Usually, the AMPs discovered are relatively short (~10–50 amino acids) and have net positive charge ranging from 2 to + 11. Typically, 50% of the AMPs contain hydrophobic residues. This nature enables them to have electrostatic attraction to the negatively charged microbial membrane [6-9]. AMPs commonly exist in two forms; α-helical and β-sheet, or peptides with extended/random-coil structure [9-11]. Of the AMPs present in the databases, 13.8% are predicted to be helical, 4% β-strand and 4% mixed type [12].

*Address correspondence to these authors at the Centre for Genomics and Applied Gene Technology, Institute of Integrative Omics and Applied Biotechnology (IIOAB), Nonakuri, PurbaMedinipur, West Bengal, India;
E-mail: dr.barh@gmail.com
Department of Genomic Science, School of Biological Sciences, Central University of Kerala, Tejaswini Hills, Periya (P.O) Kasaragod, Kerala-671316, India; E-mail: rnkumavath@gmail.com

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