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Rare Actinobacteria: A Possible Solution for Antimicrobial Drug Resistance in Egypt

Dina Hatem Amin*

Department of Microbiology, Ain shams University, Egypt

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***Corresponding author:** Dina Hatem Amin, Department of Microbiology, Faculty of Science, Ain shams University, Cairo, Egypt, Email: dina.hatem@sci.asu.edu.eg

Mini Review

"For every action, there is an equal and opposite reaction" Newton's Third Law of Motion. We can apply this rule on the overuse of antibiotics and the emergence of antimicrobial drug resistance. In the meantime, the uncontrolled practices of antibiotics mainly triggered this problem in both developed and developing countries. The intensity of antimicrobial resistance in developing countries is generally higher because of the excess antibiotics usage.

Antibiotics resistant pathogens are recognized as a gigantic worldwide public health threat, and they have vital effects concerning morbidity, mortality and elevation of healthcare costs Yong et al. [1]. In Egypt, limited data on antimicrobial resistance of food borne and blood borne pathogens were reported El Kholy et al. [2]. However, several individual attempts were performed to tackle antimicrobial resistance statistics. In 2009, Antibiotic resistance and prevalence of Streptococcus pneumoniae, *Neisseria meningitidis* and *Haemophilus influenzae* were reported Shaban and Siam [3]. Two years after, Staphylococcus aureus and coagulase-negative Staphylococcus (CNS) isolates obtained from Egyptian hospitals showed oxacillin resistance Hassan et al. [4]. In 2013, the incidence of carbapenem antibiotic resistance of Gram-negative bacteria in Egypt was detected Falagas et al. [5]. In 2015, World Health Assembly in Egypt approved an international action plan to monitor the antimicrobial resistance with some highlights such as raising awareness of community towards antimicrobial resistance through education and training; enhancing data collection to tackle antimicrobial drug resistance surveillance; reducing the risk of infection by suitable sanitation, hygiene and infection avoidance procedures and improving the investment in new medicines, diagnostic tools, vaccines and other involvements. WHO-Egypt action plan ensures the need for a real "one health" approach connecting different global multidisciplinary organizations. I believe that this is a positive action plan and I hope it will fulfill all its approaches to limit this problem. I will discuss the last approach of searching for new medicines from rare actinobacteria. Currently, it is fundamental to discover new antibiotics from distinct strains against multidrug resistant pathogens. Since unusual natural products with new structures will have valuable biological activities Koehn and Carter, Baltz, Amin et al. [6-8].

Rare Actinobacteria has a great potential to produce novel antibiotics [8-12]. My previous work focused on exploring an unordinary group of Actinobacteria, which is known as Rare Actinobacteria [13]. I successfully isolated and identified rare actinomycetes isolates from Egyptian soils and antimicrobial potential of this unique group against some food and blood borne pathogens was observed [14-17]. Rare actinomycetesare difficult to isolate and cultivate by traditional methods. Their isolation needs a pretreatment of tested samples. Various methods are used prior isolation such as (Dry heat treatment 120°C for 1hr, Sucrose gradient centrifugation, phenol and SDS treatments) [13,14]. This treatments decrease the intensity of fast growers like bacteria, fungi and common Streptomycetes. Hence, promote competence and growth of rare Actinobacteria [18]. Proper selective media having macromolecules similar to casein, chitin, humic acid and enriched with antibiotics are essential for indorsing the growth of rare actinomycetes and overwhelming bacterial and fungal contaminants [19]. Although rare Actinobacteria are isolated in low quantities, molecular tools indicated that they are comparatively abundant in different habitats and they can be recovered in large numbers if suitable isolation methods are accessible [20]. Some genera belonged to this group such as Actinomadura, Actinoplanes, Amycolatopsis, Actinokineospora, Acrocarpospora, Actinosynnema, Catenuloplanes, Cryptosporangium, Dactylosporangium, Kibdelosporangium, Kineosporia, Kutzneria, Microbiospora, Microtetraspora, Nocardia, Nonomuraea, Planomonospora, Planobispora, Pseudonocardia, Saccharomonospora, Saccharopolyspora, Saccharothrix, Streptosporangium, Spirilliplanes, Thermomonospora, Thermobifida, Virgosporangium., Micromonospora and some uncommon species of Streptomyces [13,18]. I believe that

exploring rare actinomycetes, which is difficult to isolate will outcome strains with different genetic diversity and consequently miscellaneous active compounds production.

Another approach should be put into consideration is to create novel structures through gene manipulation of rare actinomycetes genes and cloning them in heterologous hosts which can encode abnormal biosynthetic pathways and hence new activities against resistant pathogens [21]. Proper methodologies' regarding the functional analysis of biosynthetic genes is critical for such approaches. Antibiotic biosynthetic gene clustering using PCR screening assays and Illumina whole genome sequencing give a clear picture for the most possible secondary metabolites pattern produced by rare actinomycetes strains [12,16,17]. In addition to that, Bioinformatics tools for analyzing huge genomic and proteomic data will helps in the field of drug discovery and detecting novel antibiotics [22,23]. This is the aim of our research better health for better life.

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