Sciforum-045419

Antibacterial actions of fatty acids isolated from marine algae: An *in vitro* evidence-based review

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BACKGROUND

Fatty acids are a well-known molecule of diverse sources that are toxic to microorganism. As infectious diseases become a severe threat to human health and economy due to the dramatically increasing antibiotic resistance trend [1], a quest for novel antibacterial agents from natural sources, including the marine ecosystem, has increased dramatically last few decades. Seaweeds, mainly marine algae, are being studied as a potential source of bioactive molecules to combat the new trend of acquired resistance in microbes. Algae contain plenty of different fatty acids including ω3 (i.e., 16:4 ω3 and 18:4 ω3), eicosapentaenoic acid (20:5 ω3), α-linolenic (18:3 ω-3), octadecatetraenoic (18:4 ω-3) and arachidonic (20:4 ω-6). These fatty acids have a potential role in destabilizing bacterial cell membranes, causing a wide range of direct and indirect inhibitory effects [2]. Therefore, the present study summarised and discussed the available evidence related to fatty acid activities in bacterial growth inhibition.

Figure 1. *Ulva fasciata* (Chlorophyta) green algae [3].

OBJECTIVE

To evaluate the antimicrobial activity of fatty acids based on in-vitro study.

METHODOLOGY

This study was conducted according to PRISMA guidelines. The following databases were used for literature search and published within the year 2011 to 2020.

- PubMed.
- Scopus.
- Web of Science.
- Google Scholar.

RESULT AND DISCUSSION

The search was limited to *in vitro* research regarding the antibacterial role of fatty acids isolated from marine algae. The literature search revealed 570 potentially relevant records, of which 28 relevant *in vitro* studies investigated the role of fatty acids for antibacterial effects were included through the screening process. Fatty acids were isolated following the bioassay-guided fractionation of algal extracts, followed by chromatographic techniques and nuclear magnetic resonance for identification. The included studies reported various algal species as a potential source of fatty acids that were significant in inhabiting different bacterial strains limited to gram-positive: *Bacillus subtilis*, *Enterococcus faecalis*, and *Staphylococcus aureus*, and gram-negative: *Escherichia coli*, *Pseudomonas aeruginosa*, for example.

- Fresh methanol extract and ethyl acetate extract of *Grateloupia doryphora* contain fatty acids. The methanol algal extract and ethyl acetate extract had inhibitory activity on pathogenic species *P. aeruginosa* with inhibition zone 30 mm and 27 mm respectively whereas the commercial antibiotic Cephalexin, metronidazole, piperacillin, rifampicin and fusidic acid had the lowest zone of inihibiton then algal extract 0, 12, 0, 0 and 8 mm respectively [4].

- The chloroform fraction of *Ulva fasciata* extract include different fatty acids. Selective antimicrobial inhibition was observed in *S. aureus* (4mm) and *E. coli* (4mm) whereas Chloramphenicol exhibited an inhibitory diameter of 8.00 mm on *S. aureus* and 10.00 mm on *E. coli* [5].

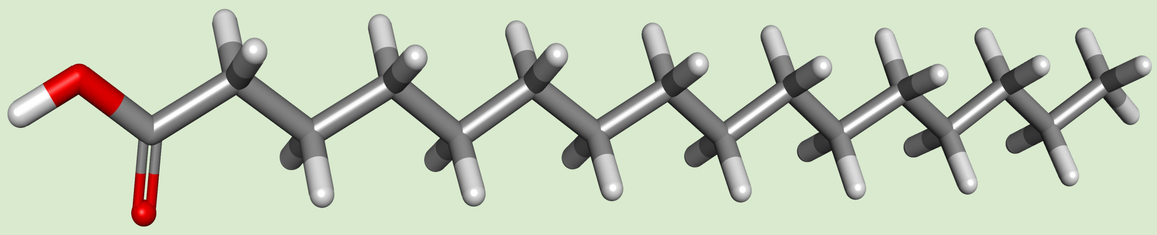

Figure 2. Palmitic acid (C-16), a common fatty acid that found in marine algae.

CONCLUSION

The present evidence recommended that the algal fatty acids as potential antibacterial agents be used as pharmaceutical products for infectious diseases.

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