

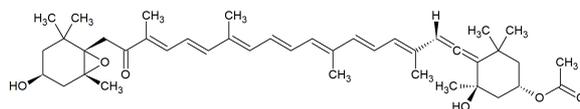
SCREENING OF ANTIBACTERIAL ACTIVITY OF FUCOXANTHIN

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- INTRODUCTION:** Fucoxanthin is an orange-coloured pigment present in brown algae (*Phaeophyceae*) and diatoms (*Bacillariophyceae*). This non-provitamin A carotenoid shows various biological activities, including antioxidant, anti-inflammatory, anti-obesity, anti-diabetic, and anticancer properties. Its antimicrobial effect is not sufficiently confirmed. Therefore, the purpose of the present work was to determine the activity of fucoxanthin against clinical strains of 20 species of bacteria.



Chemical structure of fucoxanthin.

- METHODS:** In the study, there were tested six Gram-positive bacteria (*Enterococcus faecalis*, *Staphylococcus aureus*, *S. epidermidis*, *Streptococcus agalactiae*, *S. pneumoniae*, *S. pyogenes*), and seven Gram-negative ones (*Acinetobacter lwoffii*, *Escherichia coli*, *Klebsiella oxytoca*, *K. pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Serratia marcescens*). Additionally, we investigated seven strict anaerobic pathogens (*Actinomyces israelii*, *Atopobium parvulum*, *Mitsuokella multacida*, *Peptococcus niger*, *Porphyromonas gingivalis*, *Propionibacterium acnes*, *Veilonella parvula*). The microbial growth inhibitory potential of fucoxanthin was determined according to recommendations of the Clinical and Laboratory Standards Institute (CLSI) and as described in our previous publication [1,2] using the agar disc-diffusion and the micro-dilution methods.
- RESULTS:** The obtained results indicated the biological activity of fucoxanthin against all tested strains of aerobic bacteria. The mean diameter of zone of inhibition (ZOI) ranged from 7.2 (*P. mirabilis*) to 12.2 mm (*S. agalactiae*), while the minimal inhibitory concentration (MIC) varied between 62.5 (*S. agalactiae*) and 500 µg/mL (*P. mirabilis*, *P. aeruginosa*, *S. marcescens*). Statistically significant stronger effect was observed in the case of Gram-positive (mean of ZOIs = 10.5 mm) than Gram-negative bacteria (8.3 mm). On the other hand, fucoxanthin was not active against strict anaerobic bacteria with the ZOIs of 6.0 mm and the MICs above 1000 µg/mL [3].

Antibacterial activity of fucoxanthin determined by the agar disc-diffusion and micro-dilution methods.

Studied bacterial strains	Zone of growth inhibition ZOI (mm)	Minimal inhibitory concentration MIC (µg/mL)
Gram-positive		
<i>Enterococcus faecalis</i>	9.0 ± 0.89	125-250
<i>Staphylococcus aureus</i>	11.0 ± 0.63	125
<i>Staphylococcus epidermidis</i>	11.2 ± 0.75	125
<i>Streptococcus agalactiae</i>	12.2 ± 0.75	62.5
<i>Streptococcus pneumoniae</i>	9.7 ± 0.52	125
<i>Streptococcus pyogenes</i>	10.0 ± 0.63	125
Mean of all ZOIs	10.5 ± 1.25	-
Median	10.0	125
Gram-negative		
<i>Acinetobacter lwoffii</i>	8.2 ± 0.41	250
<i>Escherichia coli</i>	10.2 ± 0.75	125
<i>Klebsiella oxytoca</i>	9.2 ± 0.75	125-250
<i>Klebsiella pneumoniae</i>	8.8 ± 0.75	250
<i>Proteus mirabilis</i>	7.2 ± 0.41	500
<i>Pseudomonas aeruginosa</i>	7.5 ± 0.55	250-500
<i>Serratia marcescens</i>	7.3 ± 0.52	500
Mean of all ZOIs	8.3 ± 1.18	-
Median	8.0	250
Anaerobic		
<i>Actinomyces israelii</i>	6.0	> 1000
<i>Atopobium parvulum</i>	6.0	> 1000
<i>Mitsuokella multacida</i>	6.0	> 1000
<i>Peptococcus niger</i>	6.0	> 1000
<i>Porphyromonas gingivalis</i>	6.0	> 1000
<i>Propionibacterium acnes</i>	6.0	> 1000
<i>Veilonella parvula</i>	6.0	> 1000
Negative control		
20% DMSO	6.00 ± 0.00	-

- CONCLUSION:** In conclusion, our study confirmed the antimicrobial activity of fucoxanthin. It seems that this substance can be a good antibacterial agent on some Gram-positive pathogens such as *S. agalactiae*, *S. epidermidis*, *S. aureus*, and weaker against Gram-negative bacteria.

[1] Karpiński T.M., Adamczak A. Antibacterial activity of ethanolic extracts of some moss species. *Herba Pol.* 2017, 63, 11-17. <https://doi.org/10.1515/hepo-2017-0014>

[2] Karpiński T.M. Efficacy of octenidine against *Pseudomonas aeruginosa* strains. *Eur J Biol Res.* 2019, 9, 135-140. <http://dx.doi.org/10.5281/zenodo.3339499>

[3] Karpiński T.M., Adamczak A. Fucoxanthin - an antibacterial carotenoid. *Antioxidants* 2019; 8(8): 239. <https://doi.org/10.3390/antiox8080239>

