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Vanillin selectively modulates the action of antibiotics against resistant bacteria

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Highlights

- Vanillin is a phenolic compound whose antimicrobial activity has been used in the elimination of pathogens present in fruits and vegetables.
- Vanillin modulated the activity of gentamicin and imipenem against *Staphylococcus aureus* and *Escherichia coli*, causing a synergistic effect, but did not affect the activity of norfloxacin, tetracycline and erythromycin against these same microorganisms.
- Vanillin showed a synergistic effect was also obtained from the association of vanillin with norfloxacin against *Pseudomonas aeruginosa*.

Abstract

The treatment of infections caused by microorganisms that are resistant to antibiotics represent one of the main challenges of medicine today, especially due to the inefficacy of long-term drug therapy. In the search for new alternatives to treat these infections, many researchers have been

looking for new substances derived from natural products to replace, or be used in combination with conventional antibiotics. Vanillin is a phenolic compound whose antimicrobial activity has been used in the elimination of pathogens present in fruits and vegetables. However, its antibacterial and modulating properties remain to be characterized. Therefore, this work aimed to evaluate the antibacterial activity and analyze the modulator activity of vanillin in association with conventional antibiotics. The antimicrobial activity of vanillin was evaluated using the microdilution method to determine the Minimum Inhibitory Concentration (MIC) Standard strains of *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, and multi-resistant strains of *Escherichia coli* 06, *Staphylococcus aureus* 10, *Pseudomonas aeruginosa* 24 were used in this study. The antibiotic modulating effect was analyzed by combining vanillin with Norfloxacin, Imipenem, Gentamicin, Erythromycin and Tetracycline against the following multiresistant bacteria strains: *Escherichia coli* 06, *Staphylococcus aureus* 10 and *Pseudomonas aeruginosa* 24. Data were analyzed using the ANOVA test of two tracks followed by the post hoc Bonferroni test. Vanillin presented CIMs $\geq 1024 \mu\text{g}/\text{mL}$ against all tested strains demonstrating that it did not present significant antibacterial activity. However, modulated the activity of gentamicin and imipenem against *S. aureus* and *E. coli*, causing a synergistic effect, but did not affect the activity of norfloxacin, tetracycline and erythromycin against these same microorganisms. A synergistic effect was also obtained from the association of vanillin with norfloxacin against *P. aeruginosa*. On the other hand, against this strain the association of vanillin with tetracycline and erythromycin caused antagonism, although the activity of gentamicin and imipenem was not affected. In conclusion, vanillin selectively modulated the activity of antibiotics against multiresistant bacteria and as such, might be useful in the development of new therapies against resistant microorganism.

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Keywords

Antibiotics; Modulation; Resistance; Vanillin

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