

## Abstract

# Impact of pH on the Antibacterial Activity of Norfloxacin in Its Combined Use with Oxalic Acid against *Escherichia coli* ATCC 25922<sup>†</sup>

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**Abstract:** The bacterial susceptibility and the translocation of fluoroquinolones (FQs) are influenced by pH, since it determines the proportion of microspecies of the drug. Norfloxacin (NOR) and oxalic acid (AO) are antibacterial compounds. In this work, we evaluated the antibacterial activity of the NOR–AO combination on the *Escherichia coli* American Type Culture Collection 25922 strain using the checkerboard method. In addition, we analyzed the effect of pH on the NOR–AO combination. We determined the extent of NOR ionization equilibrium and calculated the apparent logP to establish the lipophilicity of NOR at the different pHs assayed. The minimum inhibitory concentration (MIC) obtained for AO and NOR was 1250 µg/mL and 0.25 µg/mL, respectively. The interaction of NOR–AO was indifferent to the concentrations tested (Fractional Inhibitory Concentration 1.12). However, an atypical behavior was observed in *E. coli* growth. We observed that at pH values below 5.8 and log D below –0.3, the cationic species of NOR predominates, decreasing its activity. As pH increased, the predominant species is zwitterionic with increased lipophilicity and restoration of NOR activity. Therefore, the acid conditions given by the presence of AO decreased the concentration of the neutral species of NOR and therefore the amount of drug capable of diffusing directly through the membrane. There is controversy in the literature regarding the mechanism of FQ translocation through the bacterial membrane; however, our results show that the pH of the medium is a determining factor that directly impacts the antibacterial activity. To deepen this study, we will continue testing new concentrations and combinations with other organic acids.

**Keywords:** norfloxacin; oxalic acid; pH; logP



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