Latin American Journal of Pharmacy
(formerly *Acta Farmacéutica Bonaerense*)
Lat. Am. J. Pharm. **41** (11): 2231-6 (2022)

Received: June 26, 2022
Accepted: August 8, 2022

Combination of Caffeine with Fluoroquinolones to Explore its Potential Role as Adjuvant to Combat Antibiotic Resistance

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***SUMMARY. Salmonella typhimurium, Klebsilla pneumoniae,* and *Staphylococcus aureus* have acquired resistance against various antibiotics including the fluoroquinolones such as levofloxacin, ciprofloxacin and moxifloxacin. The objective of this study was to explore the role of caffeine as an adjuvants to combat antibiotics resistance against various antibiotics including the fluoroquinolones such as levofloxacin, ciprofloxacin and moxifloxacin. Minimum inhibitory concentration (MIC) of all the antibiotics alone and in combinations with caffeine was determined using agar dilution method. Afterward, zone of inhibition (ZoI) of all the selected antibiotics against the chosen antibiotics was studied using disc diffusion method. T-test was applied to compare the findings. For the calculation of MIC, the antibiotics were combined with caffeine in 1 mL × 1 mL concentration. The MIC of levofloxacin, ciprofloxacin and moxifloxacin was noted as 16, 256 and 128 μg/mL and with caffeine was 64 μg/mL for each. According to results, there was a decrease in the MIC of ciprofloxacin and moxifloxacin with caffeine against *S. typhi,* while MIC of levofloxacin was increased. It indicated that caffeine enhanced the efficacy of ciprofloxacin and moxifloxacin. These findings were further supported by the results of ZoI. There was a significant ($p < 0.05$) increase in the ZoI of ciprofloxacin (from 12.33 ± 1.16 to 18.33 ± 0.58) and moxifloxacin (from 12.33 ± 1.53 to 19.33 ± 0.58) with caffeine against *S. typhi*. On the other hand, ZoI of levofloxacin was non-significantly ($p > 0.05$) increased from 19 ± 0 to 19.00 ± 1.00. The findings reveal that caffeine could be used in combination with ciprofloxacin and moxifloxacin to improve their efficacy; however, the use of caffeine with levofloxacin could reduce its antibacterial efficacy.**

RESUMEN. *Salmonella typhimurium*, *Klebsilla pneumoniae* y *Staphylococcus aureus* han adquirido resistencia contra varios antibióticos, incluidas las fluoroquinolonas como levofloxacina, ciprofloxacina y moxifloxacina. El objetivo de este estudio fue explorar el papel de la cafeína como adyuvante para combatir la resistencia a los antibióticos frente a varios antibióticos, incluidas las fluoroquinolonas como la levofloxacina, la ciprofloxacina y la moxifloxacina. La concentración inhibitoria mínima (MIC) de todos los antibióticos solos y en combinación con cafeína se determinó utilizando el método de dilución en agar. Posteriormente, se estudió la zona de inhibición (ZoI) de todos los antibióticos seleccionados frente a los antibióticos elegidos mediante el método de difusión en disco. Se aplicó la prueba T para comparar los hallazgos. Para el cálculo de la MIC, los antibióticos se combinaron con cafeína en una concentración de 1 mL × 1 mL. La MIC de levofloxacina, ciprofloxacina y moxifloxacina se observó en 16, 256 y 128 μg/mL y con cafeína fue de 64 μg/mL para cada uno. Según los resultados, hubo una disminución de la CIM de ciprofloxacina y moxifloxacina con cafeína frente a *S. typhi*, mientras que la CIM de levofloxacina se incrementó. Indicó que la cafeína mejoró la eficacia de la ciprofloxacina y la moxifloxacina. Estos hallazgos fueron respaldados aún más por los resultados de ZoI. Hubo un aumento significativo ($p < 0{,}05$) en el ZoI de ciprofloxacina (de 12,33 ± 1,16 a 18,33 ± 0,58) y moxifloxacina (de 12,33 ± 1,53 a 19,33 ± 0,58) con cafeína contra *S. typhi*. Por otro lado, la ZoI de levofloxacino aumentó de forma no significativa ($p > 0{,}05$) de 19 ± 0 a 19,00 ± 1,00. Los hallazgos revelan que la cafeína podría usarse en combinación con ciprofloxacina y moxifloxacina para mejorar su eficacia; sin embargo, el uso de cafeína con levofloxacina podría reducir su eficacia antibacteriana.

KEY WORDS: agar dilution method, antibiotics resistance, caffeine, disc diffusion method, fluoroquinolones, minimum inhibitory concentration.

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ISSN 0326 2383 (printed ed.)
ISSN 2362-3853 (on line ed.)