Derivative Spectrophotometric Evaluation of the Drug-Drug Interaction Using *In-Vitro* Technique

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ABSTRACT

The study encompasses evaluating *in-vitro* DDIs between two commonly prescribed drugs, ciprofloxacin and metronidazole, in neutral medium using derivative spectroscopy. A zero-crossing method was utilized for the simultaneous determination of the drugs in mixture.

Keywords: Ciprofloxacin, Metronidazole, Derivative Spectroscopy, Zero-Crossing Method.

INTRODUCTION

Ciprofloxacin (CF) is an antibiotic, belonging to the fluoroquinolone class. It is prescribed for the treatment of aerobic bacterial infections like pneumonia and urinary tract infections. It is also used to treat sexually transmitted infections like gonorrhea, for bone, joint and skin infections, typhoid fever and lower respiratory tract infections [1]. Metronidazole (MZ) is used for treating wide range of infections caused by anaerobic bacteria and protozoa. It is a prodrug and is reduced to its active form inside the body. MZ is also used in veterinary medicines for treating different diseases in animal species [2]. The reason for selecting these two drugs is to achieve a complementary therapeutic effect as their combination provides coverage against both aerobic and anaerobic bacterial pathogens as shown in Figure **1**.

Derivative spectroscopy is based on spectra that is created from zero-order ones and today it is considered as one of the most sophisticated spectrophotometric method. This highly effective analytical technique involves measuring the rate of change of absorbance with respect to wavelength. Its benefits over traditional UV-Vis spectroscopy includes elimination of background signals, improved spectral resolution and enhanced detection limit [3].

OBJECTIVE

The main aim of this study is to determine a method which can be effectively used for the simultaneous determination of CF in the presence of MZ and vice versa in neutral medium.

METHODOLOGY

To conduct the study, pharmaceutical dosage forms (infusions) were used. In order to carry out the study, derivative spectroscopic technique is utilized so as to determine CF and MZ accurately in the mixture. All the solutions were prepared in freshly prepared distilled water at room temperature to get the neat solutions of 3, 5, 7, 9 and 11 ppm of CF and MZ. The absorbance of the solutions was determined at 0, 4 and 24 hours as shown in Figure **2**.

KEY FINDINGS

In neutral mixture the presence of MZ led to a reduction in CF recovery up to 4 hours and then increase in 24 hours. Since both the drugs exhibit recoveries below 90% at 4 hours in neutral medium, this suggests a potential

incompatibility when administered together as shown in Table **1**.

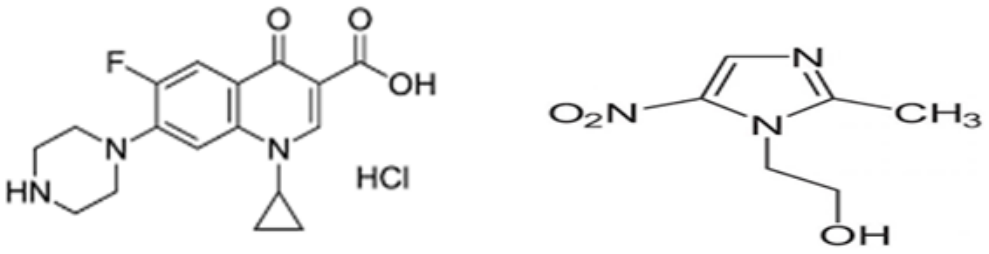

Figure 1. Chemical structures of CF and MZ.

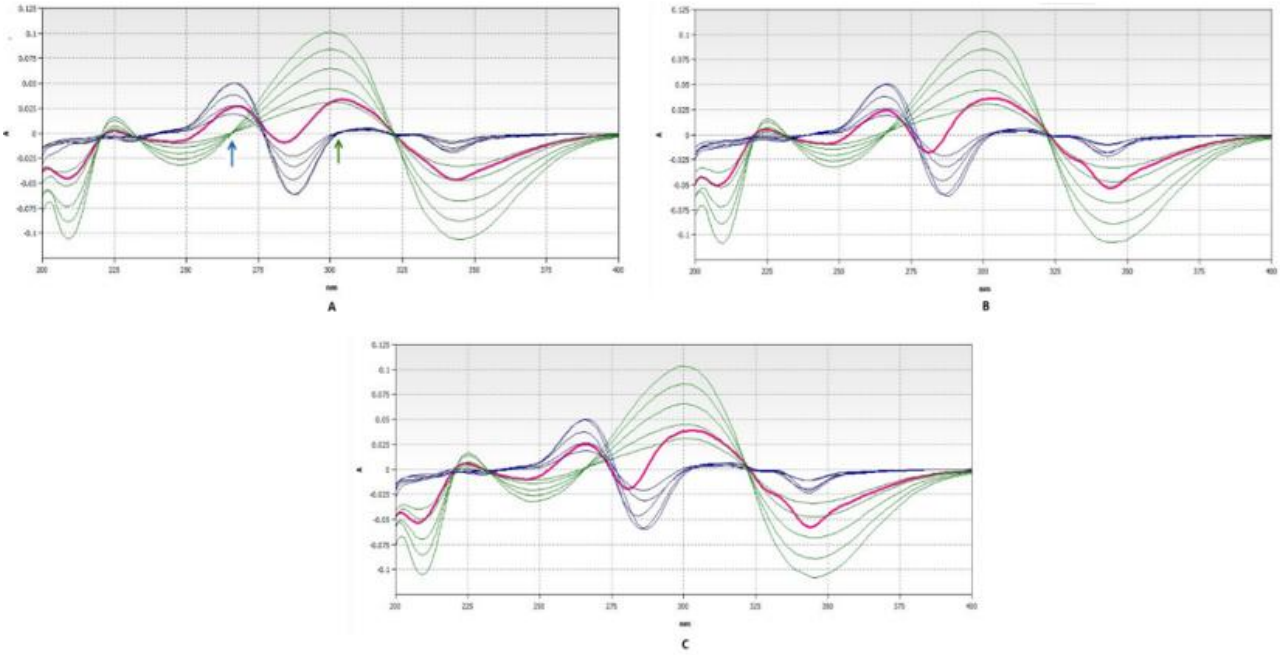

Figure 2. First derivative spectra of CF and MZ (3-11ppm) in blue and green respectively and their combination (pink) in neutral medium at 0 (**A**) 4 (**B**) and 24 hours (**C**). (zero-crossing point indicated by the arrow).

Table 1. Determination of Recovered CF and MZ in Mixture in Neutral Medium Using the First Order Derivative Spectroscopy.

	0 min.	**4 hrs.**	**24 hrs.**
	CF (λmax = 266 nm)		
Regression equation	y=0.0046x + 0.0035	y= 0.0046x + 0.0035	y = 0.0045x + 0.0035
R2	0.996	0.992	0.992
Recovery (ppm)	4.4840	4.0723	4.740
*Recovery (%)	93.75 ± 0.002	87.70 ± 0.001	100.53 ± 0.0003
	MZ (λmax = 303 nm)		
Regression equation	y=0.0084x+0.0074	y=0.0085x+0.0074	y=0.0086x+0.0075
R2	0.997	0.998	0.997
*Recovery (ppm)	3.35	3.80	3.87
*Recovery (%)	79.24 ± 0.003	78.22 ± 0.002	80.81 ± 0.001

CONCLUSION

This study involves a derivative spectroscopic method for simultaneous determination of CF and MZ in neutral medium using pharmaceutical infusions. Both the drugs showed reduced recoveries (< 90%) at 4 hours, indicating probable incompatibility raising concerns of drug-drug interaction when co-administered.

REFERENCES

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