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Simultaneous Determination of Metronidazole and Miconazole Nitrate in Pharmaceutical Formulations by RP-HPLC with Greener Solvent

Mrunalini Kulkarni and Pranay More*

Department of Chemistry, Maharshi Dayanand College of Arts, Science and Commerce, Parel, Mumbai, Maharashtra, India

***Corresponding author:** Pranay More, P. G. Department of Chemistry, Maharshi Dayanand College of Arts, Science and Commerce, Parel, Mumbai, Maharashtra, India; E-mail: more.pranay1989@gmail.com*

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ABSTRACT

The aim of this study was to develop a simple, sensitive, accurate, efficient and reproducible Reverse-Phase High-Performance Liquid Chromatography (RP-HPLC) method that maintains stability for the simultaneous determination of Miconazole nitrate and metronidazole in vaginal gel formulations. Using a diode array detector at 210 nm, chromatography was conducted on a Zorbax SB-8 column (150 × 4.6 mm, 3.5 µm) under linear elution with a combination of solvent A (water) and solvent B (isopropyl alcohol) as the mobile phase, including a flow rate of 1.0 mL/min. The linearity of metronidazole and Miconazole nitrate exhibited correlation coefficients of 0.9997 and 0.9995, respectively. The limits of detection and quantification were 0.05 µg/mL and 0.42 µg/mL for metronidazole and 0.16 µg/mL and 1.24 µg/mL for Miconazole nitrate. The technique yielded good results, with recovery rates between 98.0% and 102.0% and repeatability of ≤ 2.0%. This method is suitable for routine quality control testing of dosage forms containing these compounds due to its straightforwardness, accuracy and precision. The method's run time is reduced, leading to a lower solvent requirement. The analytical method was developed and validated to comply with ICH guidelines.

Keywords: Liquid chromatography; Method development; Method validation; Metronidazole; Miconazole nitrate

INTRODUCTION

Fungal infections are becoming increasingly common, particularly in immunocompromised individuals, necessitating the development of effective antifungal therapies. Several classes of antifungals are available, including azoles, polyenes, nitroimidazoles and allylamines, each with unique mechanisms of action and clinical applications.

Azoles such as Miconazole nitrate and fluconazole inhibit the synthesis of ergosterol, an important component of fungal cell membranes. Miconazole nitrate is often used topically and is effective in the treatment of dermatophyte infections and vaginal candidiasis.

Nitroimidazoles such as metronidazole are more commonly associated with antibacterial properties, they also have antifungal effects. It is primarily used to treat infections caused by Trichomonas vaginalis and Giardia lamblia, but may also be used off-label for certain fungal infections.3 Antibiotics and antifungals are used to treat vaginal infections. Figure 1 represents the structure of metronidazole, it has a molecular weight of 171.54 mg and has the chemical formula $C_6H_9N_3O_3$.

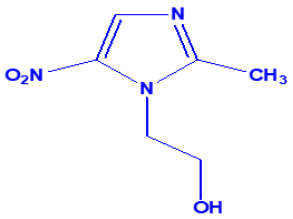

Figure 1: Structure of Metronidazole.

Mechanism of action

The low molecular weight drug metronidazole enters the microorganism by diffusing through the cell membranes of both aerobic and anaerobic microbes. However, only anaerobes have antimicrobial activity.8 By intracellular transport proteins reductive activation: In obligatory anaerobes, the pyruvate modification the metronidazole's chemical structure by reducing the ferredoxin oxidoreductase system. Pyruvate: Ferredoxin oxidoreductase typically produces adenosine triphosphate by oxidatively decarboxylation pyruvate. During this cycle, the nitro groups of metronidazole acts as an electron sink in the cellular environment, preventing electrons from being transported to hydrogen ions. A gradient in concentration is created when metronidazole is decreased which motivates the absorption of further medications and fosters the generation of cell-toxic intermediate compounds and free radicals.

Miconazole nitrate is an antifungal synthetic derivative of imidazole has some activity also against Gram-positive bacteria.10 It is frequently used to treat vaginal and oral fungal mucosal infections. There are numerous gels, suppositories, tablet-based and creams medicines accessible, even though intravenous Miconazole nitrate is no longer an option. The initial mechanism of action of Miconazole nitrate is believed to be the prevention of fungal CYP450-14α-lanosterol demethylase activity.

It is frequently applied to treat vaginal and oral mucosal fungal infections. There are numerous suppositories, gels, creams and tablet-based medicines accessible, though intravenous Miconazole nitrate is no longer an option. Figure 2. represents the structure of Miconazole nitrate, it has the molecular formula $C_{18}H_{14}C_{l4}N_2O$ and a molecular weight of 416.129 mg.

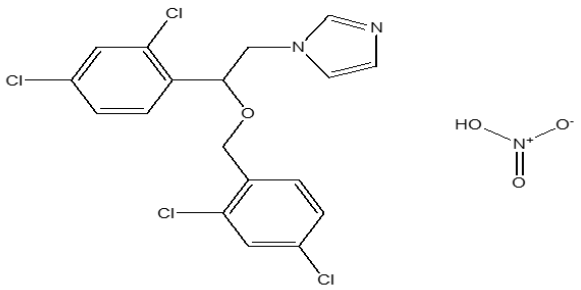

Figure 2: Structure of Miconazole nitrate.

Mechanism of action

The main way it works is by blocking the CYP450-14α-lanosterol demethylase enzyme, which changes the formation of ergosterol and impairs the cell membranes' permeability as well as composition, which leads to the leakage of low molecular weight protein, phosphate and cations. Moreover, Miconazole nitrate increases Reactive Oxygen Species (ROS) by inhibiting fungal peroxidase and catalase without changing NADH oxidase activity. Elevated intracellular ROS causes apoptosis and subsequent pleiotropic consequences. Lastly, Miconazole nitrate causes an increase in farnesol levels inside cells, which may be because it stops lanosterol from demethylating. This molecule prevents the conversion of yeast to the forms of mycelia and, consequently, the development of more antibiotic-resistant biofilms. It is connected to Candida's quorum sensing. The literature is reviewed to examine existing methods that could be examined by UV detection, HPTLC, HPLC alone and in mixture of another drug in a pharmaceutical formulation or biological fluids involving HPLC, gas chromatography, spectrophotometry, supercritical fluid chromatography. Many of the methods in this area still have problems related to more toxic organic solvents, buffers, acids, long running time and the challenge that these methods are lengthy procedures and very time-consuming. The few more sophisticated literature methods are listed in the table given in Table 1.

Table 1: Compilation of reported literature.

Sample	Chromatographic condition	Mobile phase	Reference
Simultaneous determination of metronidazole and Miconazole nitrate in dosage form	Column: µBondapak-C18,300 × 3.9 mm,10 µ Flow rate: 1.0 mL/min RT: Metronidazole-4.5 min and Miconazole nitrate-3.4 min	Methanol: water (40:60% v/v)	16
Simultaneous quantification of benzoic acid, metronidazole and Miconazole nitrate in vaginal formulation	Column: µBondapak-C18,300 × 3.9 mm,10 µ Flow rate: 1.0 mL/min RT: Metronidazole-4.5 min and Miconazole nitrate-3.4 min. Flow rate: 1.0 mL/min RT: Metronidazole-6.4 min and Tinidazole-9.2 min	Acetonitrile: phosphate buffer adjusted to pH 3.5 with orthophosphoric acid (35:65)	17
Determination of metronidazole and	RT: Metronidazole-3.3 min and Miconazole	Methanol: Water: Phosphoric acid	18

Miconazole nitrate by UV and HPLC in tablet	nitrate-2.2 min. Column: Hichrom-C18 250 × 4.9 mm, 10 µ Flow rate: 1.2 mL/min	(30:70:0.2 v/v)	
Simultaneous determination of metronidazole and Miconazole nitrate in tablet dosage form	Column: Phenomenex C18 column (150 × 4.6 mm, 5 µm Flow rate: 1 mL/min RT: Metronidazole-3.8 min and Miconazole nitrate-2.9 min	0.1% OPA: MeOH (75:25 v/v)	19
Determining Metronidazole, Lidocaine and Miconazole nitrate using RP-HPLC in semisolid dosage form	RT: Metronidazole-2.5 min and Miconazole nitrate-7.0 min. Column: Zorbax C18 (150 × 4.6 mm 5 µm Flow rate: 1.14 mL/min	Ethanol (A) and phosphate buffer (B) at different proportions starts at 0 min with 10: 90, 5.79 min changed to 75:25	20

The older approaches are increasingly showing their limitations and all of these methods have been developed for pharmaceutical dosage forms such as tablets and creams, but no method for gel formulation has ever been reported. Therefore, there is an urgent need for an economically reliable and sustainable system so that quality control laboratories can use and expand these avenues to drive further improvements. This article aimed to develop an analytical method using RP-HPLC to analyze these drugs using greener as mobile phase and the work was to describe a more precise, straightforward and accurate environmentally friendly Reverse-Phase High-Performance Liquid Chromatography (RP-HPLC) approach for the simultaneous determination of the combined dosage gel forms of Miconazole nitrate and metronidazole. The numerous parameters of the developed method are validated according to ICH guidelines.

MATERIALS AND METHODS

Reagents and chemicals

Metronidazole and Miconazole nitrate gel formulation dosage form and drug substance were procured from Encube Ethical Pvt. Ltd., Isopropyl Alcohol (IPA, 99.9%), Sodium Hydroxide (NaOH, 99.9%), Hydrochloric Acid (HCl, 36.5%) and Hydrogen Peroxide (H_2O_2, 30%) had been purchased from Merck India Ltd.

Instrumentation and chromatographic conditions

HPLC analysis was conducted on the Waters Alliance e2695 HPLC system with 2998 PDA detectors using the Empower 3 software version. The column adopted is Zorbax SB C8 (150 mm × 4.6 mm × 3.5 µ) and detection was performed at 210 nm. A 10 µL mL injection volume was employed; the column temperature had been controlled at 30ºC and the run time was 6.0 min. Water and isopropyl alcohol (70:30 v/v) made up an isocratic mobile phase. Before use, the mobile phase was degassed and passed *via* a 0.45 µm membrane filter.

Preparation of solutions

Preparation of mobile phase: Combine water and isopropyl alcohol (70:30 v/v) ratio and degassed.
Diluent/blank: Combine water and isopropyl alcohol (70:30 v/v) ratio.
Preparation of the standard solution: 15 mg of metronidazole and 40 mg of Miconazole nitrate working standard were accurately weighed along transferred to a cleaned and dried 20 mL volumetric flask. A small portion of diluent was mixed as well as sonicated to completely dissolve all components and labeled with diluent. Furthermore, 5 mL of the stock solution prepared above was accurately transferred into a clean and dried 50 mL volumetric flask marked with the diluent. (75 µg/mL metronidazole or 200 µg/mL Miconazole nitrate).
Preparation of sample solution: Weighed as well as transferred 1000 mg gel sample containing (0.75% metronidazole and 2% Miconazole nitrate) into 50 mL of dry and clean volumetric flask. To fully dissolve all of the ingredients, add around 30 mL of diluent, for up to half an hour, sonicate then fill the volume to the mark with diluent and well mix. After a few minutes of cooling at room temperature, strain through an injection filter with a 0.45 µm PTFE filter. (75 µg/mL metronidazole or 200 µg/mL Miconazole nitrate).

Method development

Various mobile phase compositions were attempted for optimal separation between metronidazole and miconazole. The mobile phase contains water and isopropyl alcohol (20:80 v/v) gave late elution and the peak was unsuitable for Miconazole nitrate, consequently, the organic composition of isopropyl alcohol (30:70 v/v) increased) with 1 mL/minute of flow rate. A column was sampled using a Zorbax SB C8 column (150 mm × 4.6 mm × 5µ). The peak shape was improved in this experiment, but the resolution was not improved. Therefore, the particle size of the column was changed with dimensions (150 mm × 4.6 mm, 3.5 µm particle size). Different wavelengths of detection were tried to examine both medicines. However, because both medications demonstrated maximum absorption, 210 nm was chosen as the detecting wavelength. The retention time was 3.46 min for metronidazole and 1.99 min for Miconazole nitrate respectively. The void volume consisted of a small amount of solvent (mobile phase) being injected into the column. The first portion of the solvent to elute from the column represents the void volume since there is no interaction between the solvent and the stationary phase. The main peak of Metronidazole and Miconazole nitrate was well separated from the void volume. This was the system suitability formula:

The Tailing factor (Tf) of an analyte peak is calculated using the formula,

$$Tf = {}^{(a+b)}/_{2a}$$

Where, 'a' is the distance from the peak's leading edge to the peak midpoint and 'b' is the distance from the peak midpoint to the trailing edge. Both a and b are measured at 5% of the peak's height.
The number of theoretical plates, N, can be calculated using the following formula derived from the chromatogram's peak width:

$$N=16(tR/W)2$$

Where:
tR=Retention time of the analyte (time taken for the compound to travel through the column).
W=Width of the chromatographic peak at its base (usually measured in time units).
Table 2 indicated the ideal chromatographic conditions, while Table 3 included the criteria for system suitability. The further optimized analytical method underwent full method validation for the intended purpose as stated in the ICH guidance.

Table 2: Analytical data.

Column	**Zorbax SB C8 column (150 mm × 4.6 mm × 3.5 µ)**
Wavelength	210 nm
Flow rate	1.0 mL/min
Injection volume	10 µL
Column oven temperature	30ºC
Run time	6 min
Retention Time	1.98 for Miconazole nitrate and 3.60 for Metronidazole

Table 3: Characteristics of IR absorption bands.

Parameter	**Metronidazole**	**Miconazole nitrate**	**Acceptance criteria**
% RSD (Peak area)	0.09	0.12	NMT 2.0%
Tailing Factor	1.3	1.1	NMT 2.0
Theoretical plate	2685	3429	NLT 2000

Method Validation

According to the ICH guidance, the goal of method validation is to show that the procedure is appropriate for the intended use. Following ICH principles, the aforementioned method has been validated to ascertain the method's performance characteristics (represented in analytical parameters) and to satisfy the needs for the method's intended use. They were examined using chromatographic conditions and equipment that were optimized.

Specificity

The spectral purities of the metronidazole and Miconazole nitrate chromatographic peaks were examined according to the methodology for interferences of the degradation components, gel excipients or because of the presence of contaminations. To assess any interfering peaks, a solution including a blend of the gel excipients was made utilizing the sample preparation technique.

Forced degradation study

The sample was subjected to acid, base, oxidizing, heating and photolytic conditions to perform the forced degradation investigation. The placebo was also exposed to identical stress conditions to determine whether peak levels were caused by the specified excipients. The sample was treated with 5 mL of hydrochloric acid (2 N) at room temperature for 3 hours to degrade it. The sample was treated using sodium hydroxide (2 N, 5 mL) for three hours at room temperature to degrade the base. To break down the material under oxidizing conditions, 30% hydrogen peroxide was applied for 3.5 hours at room temperature. The material was subjected to a 24 hr thermal breakdown process at 105ºC in an oven. The sample was subjected to light in a photo stability room with a minimum total illumination of 1.2 million lux hours to undergo photo degradation.

Linearity and Range

The analytical method's capacity for producing test findings that are exactly proportionate to the sample's analyte concentration (within a specified range) is known as linearity. Serial dilutions of a working standard stock solution were analyzed to ascertain the linearity of the detector response for metronidazole and Miconazole nitrate. Five concentrations like 18.75 µg/mL (25%), 37.5 µg/mL (50%), 60 µg/mL (80%), 75 µg/mL (100%), 90 µg/mL (120%), 112.5 µg/mL (150%) for metronidazole and 50 µg /mL (25%), 100 µg/mL (50%), 160 µg/mL (80%), 200 µg/mL (100%), 240 µg/mL (120%), 300 µg/mL (150%) Miconazole nitrate prepared and analyzed according to Tables 4, 5. Both the %Y-intercept and the correlation coefficient ought to fall inside the range. The residual sum of squares of the areas of each level, the regression line's slope, the correlation coefficient and the percent Y-intercept were computed.

Table 4: Linearity concentration levels of Metronidazole.

Linearity level	Volume was taken from each stock in (mL)	Diluted to volumetric flask	Concentration in PPM (µg/mL)
25%	1.25	50	18.75
50%	2.5	50	37.5
80%	4	50	60
100%	5	50	75
120%	6	50	90
150%	7.5	50	112.5

Table 5: Linearity concentration levels of Miconazole nitrate.

Linearity level	Volume was taken from each stock in (mL)	Diluted to volumetric flask	Concentration in PPM (µg/mL)
25%	1.25	50	50
50%	2.5	50	100
80%	4	50	160
100%	5	50	200
120%	6	50	240
150%	7.5	50	300

Limit of Detection (LOD) and Limit of Quantification (LOQ)

The Signal-to-Noise ratio (S/N) was used to determine the limits of detection and quantification, which were 3:1 and 10:1, respectively. The LOD stated that the analyte peak could be detected but not quantified, while the LOQ indicated that it could be both detected and quantified.

Accuracy

A known quantity of working standards was added to a placebo that matched the accuracy level to calculate accuracy. Three distinct solutions of Metronidazole were prepared in triplicate at 50%, 100% and 150% of the predefined concentration (37.5, 75, 112.5 µg/mL). Miconazole nitrate was prepared in triplicate at 50, 100 and 150% of the predefined concentration (100, 200, 300 µg/mL) and the mean percent and individual recovery were calculated.

Method precision (Repeatability)

The repeatability of an analytical technique is the degree of agreement among a set of measurements made by repeatedly sampling the same homogenous sample under predetermined conditions. It was produced using six determinations of identical homogenous samples of completed dosage forms with a 100% test concentration. The estimated results' standard deviation and Relative Standard Deviation (%RSD) were determined.

Intermediate precision

Two independent repeatability experiments conducted on two distinct days are compared to determine the test method's average precision. Day 1 data comes from the "repeatability" analysis. The second series of experiments is also carried out by a different analyst on several instruments. Calculations are made to determine the standard deviation as well as the relative standard deviation of the values obtained. The findings of the first-day analysis are contrasted with the intermediate precision result.

Robustness

The analytical technique's capacity to remain unaltered by slight but intentional changes in the method parameters is a measure of its robustness, which also shows how reliable it is in typical operating conditions. Variations in the temperature of the column oven, the composition of the mobile phase, the flow velocity, etc., were noted.

RESULTS AND DISCUSSION

Specificity

Specificity is the capability of assessing the analyte in the existence of anticipated components. When comparing the chromatograms shown in Figures 3-7 of the blank, Standard, the peak identification of metronidazole, the peak identification of Miconazole nitrate and sample solution. When comparing the retention times of metronidazole and Miconazole nitrate, it was discovered that there was no interference from a peak. The test solution passed the acceptance criteria and the reference solution yielded the retention time of the chromatogram's primary peaks (Miconazole nitrate and metronidazole). This validated the method's specificity.

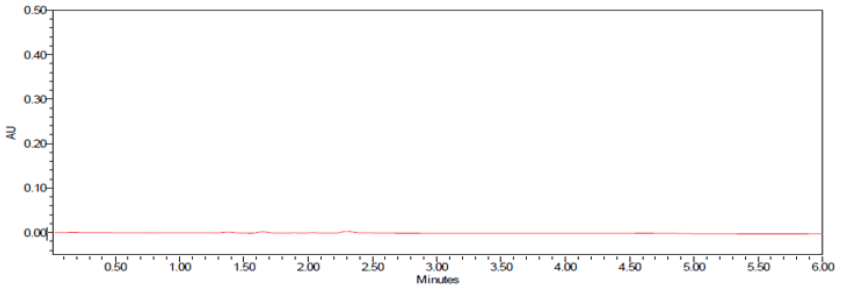

Figure 3: Blank chromatogram of Metronidazole.

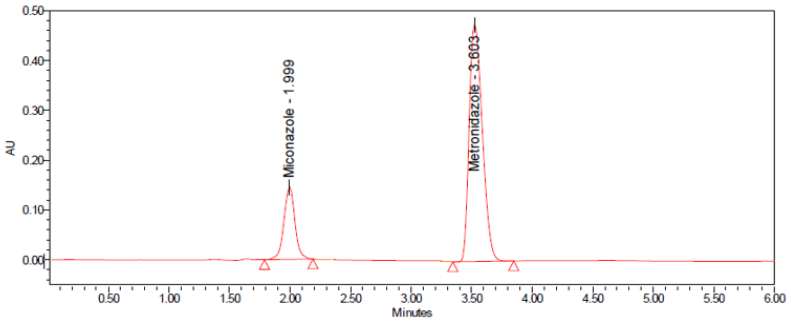

Figure 4: Representative standard chromatograms.

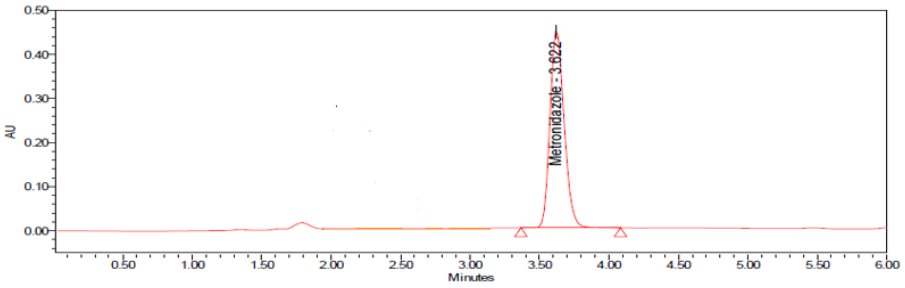

Figure 5: Representative metronidazole Peak ID chromatogram.

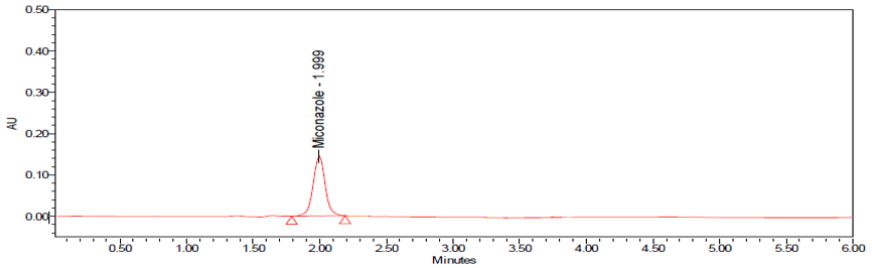

Figure 6: Representative Miconazole nitrate Peak ID chromatogram.

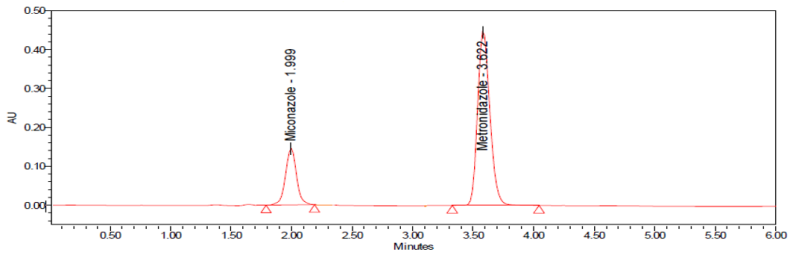

Figure 7: Representative sample chromatograms.

Forced degradation study

The study on forced deterioration was conducted to ensure that the technique is specific and also, shows stability. The sample is exposed to several conditions, including oxidative, photolytic, thermal, basic and acid destruction. Any interference caused by the peaks eluting under all stress conditions was checked concerning the retention time of metronidazole and Miconazole nitrate. No impairment could be detected. Furthermore,

degradation of 5 to 20% was achieved under all conditions. Table 6 provides the difference between the controlled and degraded sample and the percent content observed after each stress condition.

Table 6: The observed results of forced degradation.

Degradation Condition	% Assay of Metronidazole	% Assay of Miconazole nitrate	Difference between a controlled and degraded sample	
			Metronidazole	Miconazole nitrate
Controlled sample	100.3	99.6	-	-
Acid condition	94.6	92.1	5.7	7.5
Base condition	92.9	93.5	7.4	6.1
Oxidation condition	95.1	94.2	5.2	5.4
Thermal condition	93.9	94.4	6.4	5.2
Photolytic condition	98.6	96.8	1.7	2.8

Linearity and range

The linearity study was carried out using five concentrations such as 18.75 µg/mL (25%), 37.5 µg/mL (50%), 60 µg/mL (80%), 75 µg/mL (100%), 90 µg/mL (120%), 112.5 µg/mL (150%) for metronidazole and 50 µg/mL (25%), 100 µg/mL (50%), 160 µg/mL (80%), 200 µg/mL (100%), 240 µg/mL (120%), 300 µg/mL (150%) for Miconazole nitrate. Figures 8 and 9 display plots of concentration in µg/mL (x-value) against response (area observed) (y-axis). Table 7 displays the residual sum of squares results, the correlation coefficient, as well as the percentage Y-intercept of the slope of the regression line. For metronidazole, the technique turned out to be linear between 18.763 µg/mL (25%) and 112.567 µg/mL (150%) of the target concentration and for Miconazole nitrate, between 50.165 µg/mL (25%) and 300.495 µg/mL (150%) of the target concentration.

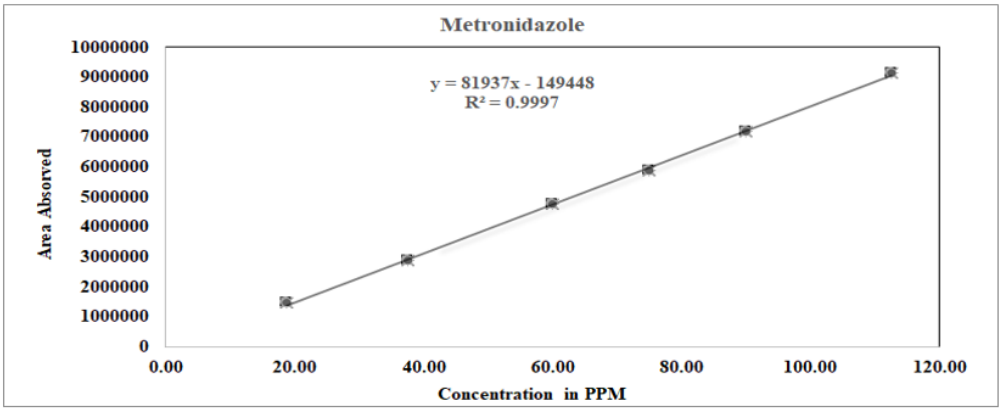

Figure 8: Linearity plot of Metronidazole.

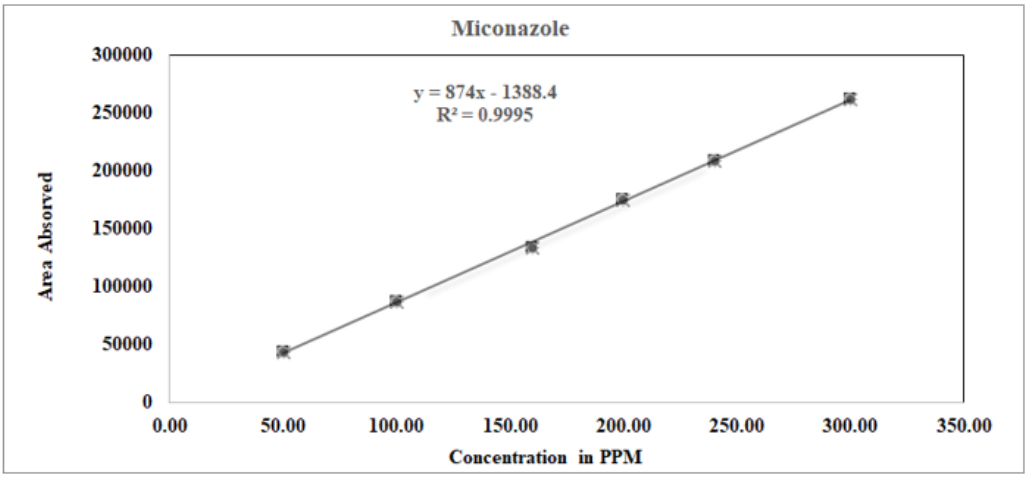

Figure 9: Linearity plot of Miconazole nitrate.

Table 7: Linearity plot of Metronidazole and Miconazole nitrate.

Parameter for linearity	Values		Acceptance criteria
	Metronidazole	Miconazole nitrate	
Correlation coefficient R	0.9997	0.9995	>0.999
Slope	81936.68	873.62	Complies
Y intercept	149447.6	1388.44	Complies
%Y-axis intercept	2.5	0.8	≤ ± 5 %
LOD	0.05 µg/mL	0.42 µg/mL	Complies
LOQ	0.16 µg/mL	1.24 µg/mL	Complies

Accuracy

The correctness of the analytical procedure is determined by how closely the experimental value matches the true value. The accuracy of the strategy was explored by employing the standard addition technology. The area before and after the standard medicine is added is compared to examine the percentage recovery. The percentage recoveries of metronidazole and Miconazole nitrate were 100.3% and 101.8%, respectively, showing the accuracy of the method. Table 8 shows the recovery at various concentration levels. The mean recovery values between the prescribed limit of 98-102% and the individual recoveries for both active ingredients between the prescribed limit of 98 to 102% show that there are no interference excipients in the formulation and that the procedure is accurate.

Table 8: The percentage recovery of Metronidazole and Miconazole nitrate.

Accuracy level	Mean recovery	
	Metronidazole	Miconazole nitrate
50%	99.9	99.6
100%	100.5	100.1
150%	100.6	99.7
% Overall recovery	100.3	99.8
% RSD	0.56	0.28

Method precision (Repeatability)

The degree of agreement between a set of measurements taken from several samples of the same homogenous material is known as precision. On the same day, six injections of a known concentration of Miconazole nitrate (200 µg/mL) and Metronidazole (75 µg/mL) were made and tested on an HPLC column. The precision of the technique in the sense of precision and method is precise. Table 9 shows mean, % RSD, was computed as follows because the relative standard deviation from six conclusions falls well inside the acceptable range.

Table 9: Method precision data.

Sample No.	% Assay	
	Metronidazole	Miconazole nitrate
Sample 1	99.8	99.8
Sample 2	100	98.7
Sample 3	99.9	99.7
Sample 4	100.6	100.2
Sample 5	100.1	98.9
Sample 6	100.4	98.7
Mean	100.1	99.3
% RSD	0.31	0.65

DISCUSSION

Analytical techniques are crucial to the creation and manufacturing of pharmaceutical products. The majority of the time, LC techniques like HPLC are employed to analyze pharmaceutical formulation dosage forms of all kinds, nutraceuticals and active pharmaceutical ingredients.41 The intricacy of a medication product compounds the challenges of technique development, making it challenging. Making sure a method is resilient is

one of the most crucial parts of its development and it should be assessed concurrently. Robust methods can achieve reproducible, reliable and consistently high-quality results. The maximum absorption of metronidazole and Miconazole nitrate was observed at 210 nm. The suggested method for simultaneous estimation of both medications was validated regarding specificity, repeatability, intermediate precision, linearity, robustness and accuracy following the ICH guidance.

The separation of both active ingredient components in the developed method takes place under different stress conditions. The results obtained demonstrate that elevated temperatures (thermal exposure), light exposure, oxidation, base degradation and acid degradation were observed on the sample within the specified degradation range, with total impurities ranging between 5.0% and 20% as an indication of stability. One of the advantages of HPLC is its versatility. HPLC chromatography is used in numerous applications. Chromatographic performance is likely to become essential because of the vast number of variables involved, particularly if the critical elements affecting separation are not appropriately handled. To investigate how these elements and their interactions affect a certain response, one or more factors are changed at the same time. The linearity study was carried out using five concentrations and revealed that both active molecules were linear over the entire range. Recoveries at known drug concentrations were used

to assess the method's accuracy. The percent recoveries of metronidazole and Miconazole nitrate were 100.3% and 99.8%, respectively. Method precision and intermediate levels were performed independently and the distinction between two repeatability experiments on two different days resulted well within the acceptance limit. Calculations are made to determine the SD and RSD (relative standard deviation) of the values obtained. The outcomes of the first-day analysis and the intermediate precision results are contrasted. All assessed robustness parameters satisfied the system appropriateness criteria, demonstrating the method's resilience. The established RP-HPLC technique is robust, as demonstrated by the fact that purposefully altering the parameters had no discernible effect on the method's performance.

CONCLUSION

The development and validation of the RP-HPLC technique for the simultaneous measurement of metronidazole together with Miconazole nitrate are the focus of this work. This is very important because the RP-HPLC method has a shorter running time and provides good resolution between metronidazole and Miconazole. Due to the shorter run time, the time and cost of analyzing commercial drug samples are dramatically reduced. The developed RP-HPLC method is simple and fast for stability indicating and ensuring product quality with a high degree of accuracy, which is better beneficial to the pharmaceutical company and humanity. A selective, accurate, rapid and stability indicating HPLC technique for the quantification of metronidazole and Miconazole in pharmaceutical dosage forms has been advanced and validated. The earlier approaches took a lot of time. The current study developed and validated a novel HPLC methodology for the simultaneous measure of metronidazole and Miconazole nitrate in a pharmaceutical gel dosage form that is straightforward, linear, precise, accurate and robust following ICH guidelines. As a result, regular examination of metronidazole and Miconazole nitrate together in pharmaceutical gel form may benefit from this approach.

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CONFLICT OF INTEREST

The authors declared that there is no conflict of interest.

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