Simultaneous Analysis of Trimethoprim and Sulphamethoxazole Drug Combinations in Dosage Forms by High Performance Liquid Chromatography

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ABSTRACT

A sensitive high performance liquid chromatography (HPLC) analytical procedure was developed for the quantitative determination of trimethoprim (TM) and sulphamethoxazole (SM) in commercial dosage forms. C18 analytical column (stainless steel, 25 cm × 4.6 mm i.d.) was packed with 5-μm particles of the reversed phase material and used for assays. Mobile phase containing 0.025 M sodium phosphate as aqueous phase and acetonitrile with 0.4% triethylamine as organic phase. The drugs were quantified at flow-rate of 1.2 ml/min, with ultraviolet detection at 260 nm. The minimum detectable quantities in assays were 100 ng/ml for SM and 75 ng/ml for TM. The method is well suited to routine application and adequate sensitivity with precision.

Keywords: Trimethoprim, Sulphamethoxazole, Co-trimoxazole, HPLC

INTRODUCTION

Co-trimoxazole [trimethoprim (TM)-sulphamethoxazole (SM)] is a broad spectrum anti-microbial agent composed of a fixed combination of a diamino-pyrimidine and a sulphonamide [1]. It was developed by the systematic investigation of a series of compounds known to be specific enzyme inhibitors of bacterial folate synthesis. Co-trimoxazole has a wide range of activity against both Gram-positive and Gram-negative aerobic bacteria: chlamydia, actinomycetes and Protozoa [2-5]. Many anaerobic organisms including Bacteroides fragilis, can be shown to be susceptible \textit{in vitro} as well [6].

Co-trimoxazole has been shown to be effective in acute and persistent or recurrent urinary tract infections, (treatment and prophylaxis), ear, nose, throat infections, acute exacerbation of the chronic bronchitis and enteric fever [7]. A synergy or summation effect between the 2 drugs (TM and SM in a 1:5 ratio) has been demonstrated both \textit{in vitro} and in most studies [8]. For most organisms, the optimum ratio for maximum potentiation is about 1:20 (TM : SM), which is the approximate ratio present in plasma after administration of the standard formulation. The usual recommended adult dosage is 2 standard tablets (TM 160 mg, SM 800 mg) twice a day. In children, the usual oral dose is 4 mg/kg TM, 20 mg/kg SM given twice daily\textsuperscript{[1]}

A general approach for the determination of TM and SM is high performance liquid chromatography (HPLC) analysis because HPLC provides adequate sensitivity and precision for monitoring therapeutic steady state concentration [9, 10]. We report here an HPLC method capable of quantifying TM and SM simultaneously.

MATERIALS AND METHODS

\textit{Chemicals and reagents}. All chemicals were of analytical grade. TM and SM were purchased from Sigma (USA) and Sobhan company (Iran). O-amino benzoic acid (OABA) and HPLC grade solvents were obtained from Merk (Germany).

Stock solution of TM was prepared by dissolving TM in the mixture of 0.02 M phosphoric acid and ethanol (1:1). Stock solution of SM was prepared...
by dissolving the compounds in a small amount of acetone and diluting to volume with ethanol. OABA was prepared in ethanol.

**Chromatographic condition.** The chromatographic system for UV detection of the analyte was consisted of Waters 510 pump, gradient controller of Waters and Waters 486 UV detector. The integration was carried out using the Waters 746 Data Module. The detector was operated at 260 nm. C18 analytical column (stainless steel, 25 cm × 4.6 mm i.d.) and guard column (stainless steel, 2 cm × 4.6 mm i.d.) were packed with 5 μm particles of the reversed phase material.

The mobile phase was 0.025 M sodium phosphate (pH 2.8 adjusted with 5 mM phosphoric acid) acetonitrile with 0.4% triethylamine added (80/20, v/v). The flow-rate was 1.2 ml/min. Aliquots of 2 μl were injected onto the column for the determination of TM and SM.

**Calibration curves.** Calibration curves were obtained by plotting the ratio of the area of each compound to the internal standard, OABA, versus their respective concentrations using five different concentrations of TM and SM were linear over all the concentration ranges studied.

**RESULTS AND DISCUSSION**

The necessity of assuring the quality of polydrugs, especially those with low aqueous solubility and *in vivo* absorption, has led to the development and evaluation of new techniques that can reduce the time and cost of analysis [11]. A number of procedures such as microbiology, thin layer chromatography, and gas chromatography have been described for the determination of sulphonamides in combination with TM in biological fluids and pharmaceutical preparation [12, 13]. Microbiological and immuno-assay methods are not considered very specific and may give false positive results [14]. Thin layer chromatography has been used for the detection of sulpha drug and TM, but this method has limited application and is generally used only for screening or qualitative analysis. Gas chromatography methods have not gained wide acceptance [14]. Several HPLC methods for the determination of TM alone or in combination with a sulphonamide, have been published [14, 15]. Most of the published methods

**Fig. 1.** Structure of trimethoprim (top), and sulphamethoxazole (bottom).

**Fig. 2.** HPLC chromatogram of TM, SM and OABA, chromatographic conditions: column C18 (25 cm × 4.6 mm i.d.); mobile phase, 0.025 M sodium phosphate as aqueous phase and acetonitrile with 0.4% triethylamine as organic phase (80/20); HPLC flow-rate 1.2 ml/min and ultraviolet detection (wavelength 260 nm).
required the application of either complicated solvent-switching techniques or extensive and laborious sample treatment prior to analysis, thus rendering them unattractive for routine laboratory use [16]. The objective of this study was to develop a simple and sensitive laboratory method for the analysis of trimethoprim and ST which could be routinely used to verify the qualitative

**Table 1.** Ratio of TM and SM area to the internal standard, OABA, versus their concentrations using five different concentrations of TM and SM

<table>
<thead>
<tr>
<th>Trimethoprim</th>
<th>Sulphamethoxazole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration (µg/ml)</td>
<td>TM/OABA area ratio</td>
</tr>
<tr>
<td>1</td>
<td>0.27</td>
</tr>
<tr>
<td>2</td>
<td>0.073</td>
</tr>
<tr>
<td>4</td>
<td>0.153</td>
</tr>
<tr>
<td>8</td>
<td>0.332</td>
</tr>
<tr>
<td>16</td>
<td>0.571</td>
</tr>
</tbody>
</table>

r = 0.986 r = 0.949

responses obtained with dosage form (Figure 1). Reverse-phase liquid chromatographic determination of trimethoprim in mouse liver.

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