Journal of Pharmaceutical and Biomedical Analysis 96 (2014) 241–248

Contents lists available at ScienceDirect

Journal of Pharmaceutical and Biomedical Analysis

journal homepage: www.elsevier.com/locate/jpba

Simultaneous determination of oral antidiabetic drugs in human plasma using microextraction by packed sorbent and high-performance liquid chromatography

Iara Maíra de Oliveira Viana, Paula de Paula Rosa Lima, Cristina Duarte Vianna Soares, Christian Fernandes*

Departamento de Produtos Farmacêuticos, Faculdade de Farmácia, Universidade Federal de Minas Gerais, Av. Pres. Antônio Carlos 6627, 31270-901 Belo Horizonte, MG, Brazil

ARTICLE INFO

Article history:
Received 23 December 2013
Received in revised form 10 March 2014
Accepted 25 March 2014
Available online 2 April 2014

Keywords:
Oral antidiabetic drugs
Microextraction by packed sorbent
Experimental design
Fused-cored column
Human plasma

ABSTRACT

In this study, a simple method using microextraction by packed sorbent and high-performance liquid chromatography with ultraviolet detection for simultaneous determination of chlorpropamide, gliclazide and glimepiride in human plasma was developed and validated. A fractional factorial design and a complete factorial design were applied to evaluate the parameters which could affect the extraction and desorption steps, respectively. All parameters in the extraction step (pH, sample volume, sample dilution and number of aspiration/ejection cycles) and in the desorption step (percentage of acetonitrile in the elution solvent and number of aspirations of elution solvent through the device) were statistically significant ($p > 0.05$) when recovery was used as response. The developed method allowed the use of small volumes of sample and solvents and rapid separation by using a fused core column (only 2.2 min were needed). This method was fully validated showing selectivity, precision, accuracy and linearity over the range 1.0–50.0 $\mu g\,mL^{-1}$ for chlorpropamide, 1.0–10.0 $\mu g\,mL^{-1}$ for gliclazide and 0.1–1.0 $\mu g\,mL^{-1}$ for glimepiride. Finally, the validated method was applied in the analysis of samples from volunteers containing the three tested analytes.

© 2014 Elsevier B.V. All rights reserved.

1. Introduction

Diabetes mellitus is a chronic disease that occurs when pancreas does not produce enough insulin, or when cells do not respond to the insulin that is produced. Hyperglycemia, which could cause serious damage to many body's systems, is a common effect of uncontrolled diabetes. According to World Health Organization, approximately 347 million people have diabetes mellitus worldwide and it will probably be the seventh leading cause of death in 2030 [1].

The non-pharmacological diabetes treatment – healthy diet and regular physical activity – can prevent or delay the onset of type 2 diabetes mellitus (T2DM) [1]. However, lifestyle modification alone is usually not able to achieve appropriate glycemic levels. Patients with T2DM are usually treated with oral medication or even insulin. Often the use of a single drug is unlikely to result in long-term glycemic control and patients require multiple agents with different mechanisms of action [2].

The sulfonylureas are insulin secretagog agents which are commonly prescribed with metformin when the first-line treatment (metformin monotherapy) failed [2,3]. Beyond that, the sulfonylureas become the first line option for people with normal weight or when metformin should not be taken [4]. Also, they must be the first choice when the patient has weight loss or too high blood glucose [3].

There are two groups of sulfonylureas, the first and second generation, but all drugs consist of substituted arylsulfonylureas (Fig. 1). The first generation group includes chlorpropamide (CL), tolazamide, acetohexamide and tolbutamide; while the second one contains glibenclamide (GB) (also known as glyburide), gliclazide (GZ), glimepiride (GM) and glipizide [5].

Determination of drugs in biological fluid is essential in therapeutical drug monitoring, pharmaceutical research, analytical and toxicological studies. However, conventional sample preparation methods are usually laborious, time-consuming and are

* Corresponding author at: Departamento de Produtos Farmacêuticos, Faculdade de Farmácia, Universidade Federal de Minas Gerais, Av. Presidente Antônio Carlos, 6627 Campus Pampulha, 31270-901 Belo Horizonte, MG, Brazil.
Tel.: +55 31 34096957; fax: +55 31 34096976.
E-mail address: cfernandes@farmacia.ufmg.br (C. Fernandes).

http://dx.doi.org/10.1016/j.jpba.2014.03.042
0731-7085/© 2014 Elsevier B.V. All rights reserved.

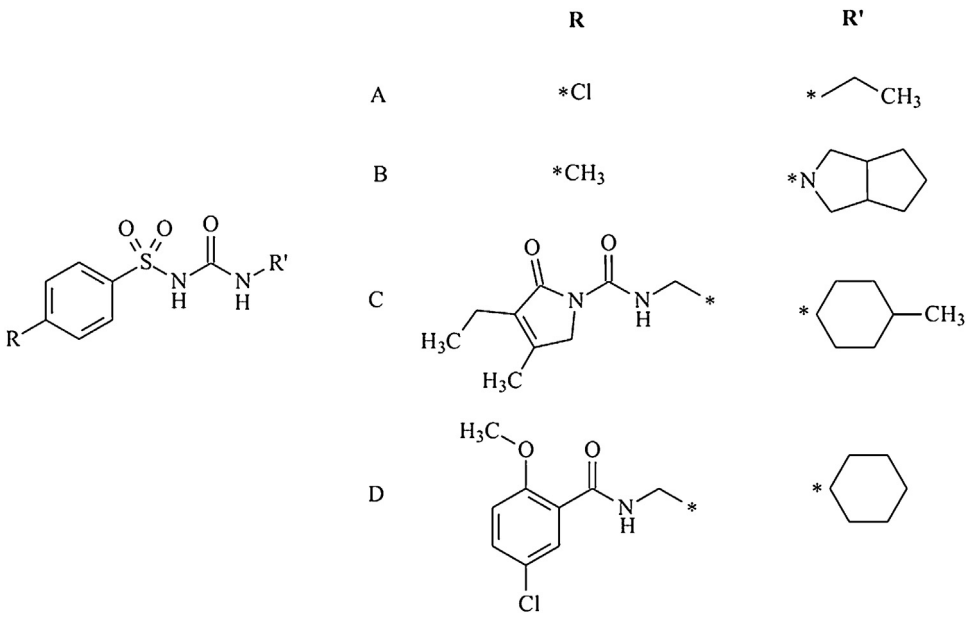

Fig. 1. Chemical structures of the sulfolnylureas (A – chlorpropamide; B – gliclazide; C – glimepiride; D – glibenclamide).

responsible for at least one-third of the error generated during the performance of an analytical method. Moreover, they employ large sample volumes and toxic solvents [6–8].

Until now, several analytical methods have been described for the determination of CL, GZ or GM in human plasma samples. However, from our knowledge, in all of them conventional techniques, such as protein precipitation (PP) [9–13], liquid–liquid extraction (LLE) [14–18] and solid-phase extraction (SPE) [19,20], were employed.

Microextraction by packed sorbent (MEPS) is a new miniaturized solid-phase extraction technique that can reduce the volume of solvent and sample needed. Furthermore, it is easy to use and rapid. The sorbent (1–4 mg) is inserted into the syringe (100–250 μL) barrel as a plug or between the needle and the barrel as a cartridge [21]. It is a very versatile technique, since this cartridge can be packed with any solid-phase material such as silica-based (C2, C8, C18), restricted access material (RAM) or molecularly imprinted polymers (MIPs) and can handle small sample volumes (10 μL of plasma, urine or water) as well as large volumes (1000 μL). Compared with PP, LLE and SPE, MEPS can reduce sample preparation time and organic solvent consumption [22], as have already been reported for determination of other drugs in biological samples [23–29]. One of the most advantages of this technique is that the sorbent could be used several times; more than 100 times with plasma or urine samples, while conventional SPE cartridges is used only once. The washing step after extraction allows and increases reuse. Moreover, using appropriate pretreatment of the sample before the MEPS method, blockage and coagulation are avoidable. Commonly, pretreatment includes centrifugation to remove suspended materials, pH adjustment, hydrolysis or precipitation [30].

In this context, the aim of this study was to develop a modern and fast method to simultaneously determine CL, GZ and GM in human plasma. Despite the fact that these three drugs are not usually co-administered in the clinical practice, the proposed method allows the determination of CL, GZ and GM together or alone, avoiding the need for developing three independent methods. MEPS was used as sample preparation technique. Experimental design was employed to optimize the parameters that affect the extraction. Liquid chromatography was performed by using a fused core column, which allowed rapid and efficient separation. The developed method was validated according to Brazilian legislation and applied to the analysis of samples from volunteers.

2. Materials and methods

2.1. Chemicals, reagents and materials

CL batch 1019, GZ batch 1057 and GB batch 1018 (used as internal standard – IS) analytical standards were purchased from Instituto Nacional de Controle de Qualidade em Saúde (Rio de Janeiro, Brazil). GM batch G0K135 analytical standard was obtained from United States Pharmacopeia (Rockville, USA). GB by Cadila Pharmaceuticals (Ahmedabad, Gujarat, India), GM by Mantena Laboratories (Nalgonda Dist, Andhra Pradesh, India), GZ by Shandong Keyuan Pharmaceutical (Jinan, Shandong, China) and CL by Kothari Phytochemicals International (Nagari, India) active pharmaceutical ingredients were used in the optimization step. Three different drug products were obtained in the local market: tablets containing 250 mg of chlorpropamide, 30 mg of gliclazide and 4 mg of glimepiride.

Acetonitrile and methanol HPLC grade and sodium citrate dehydrate analytical grade were obtained from J.T. Baker (Xalostoc, Mexico). Phosphoric acid 85% (w/w) and sodium hydroxide were acquired from Merck (Darmstadt, Germany). Potassium phosphate monobasic was supplied by Sigma-Aldrich (São Paulo, Brazil); citric acid monohydrate and sodium carbonate anhydrous by Labsynth (Diadema, Brazil); and sodium bicarbonate by Vetec (Rio de Janeiro, Brazil). The water used for preparing all solutions and samples was purified in a Direct-Q 3 System from Millipore (Bedford, MA, USA).

Extraction was performed using the MEPS 250 μL syringe and the MEPS BIN (barrel insert and needle) containing 4 mg of silica C18 sorbent (SGE Analytical Science; Melbourne, Australia).

2.2. Sample collection

Blood samples were collected from volunteers at Laboratório de Hematologia da Faculdade de Farmácia da Universidade Federal de Minas Gerais (UFMG; Belo Horizonte, Brazil). This study was approved by UFMG Ethics Committee. The blood samples were usually drawn in the morning from fasting volunteers and stored in glass tubes containing heparin as the anticoagulant until been

Download English Version:

https://daneshyari.com/en/article/1221673

Download Persian Version:

https://daneshyari.com/article/1221673

Daneshyari.com