Al Zahrawi University College

Department of Pharmacy

Graduation Research

Comparative Technical Quality Assessment of Iraqi-Manufactured Generic Rosuvastatin Tablets and the Brand, Crestor®

By students

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Abstract

The aim of this study is to evaluate the technical quality of commercially available Iraqi-manufactured generic rosuvastatin tablets. Three 10-mg generic products were assessed for hardness, friability, content uniformity, and dissolution in comparison with the reference brand, Crestor® (AstraZeneca). No statistically significant differences were found in hardness, friability, content uniformity, and dissolution between each of the generic tablets and the brand. All tested products met the USP acceptance criteria. The findings of this study indicate that the three Iraqi-manufactured generic products available in the Iraqi market exhibit good quality and perform comparably to their brand counterpart.

Introduction

Generic medications are widely recognized for their safety, efficacy, and cost-effectiveness, providing significant benefits from both medical and economic perspectives [1,2,3]. However, ensuring that generic drugs meet established quality standards is essential. Given the potential risks associated with selecting generic medications for use in pharmacies and hospitals, it is crucial to verify that these products are safe, effective, and of high quality before being marketed and prescribed [4].

In this study, three Iraqi-manufactured 10-mg rosuvastatin generic products (Zerotin®, Sama Al-Fayhaa; Rosatin®, Awamedica; and Rosva®, Pioneer) were selected for technical quality evaluation. Their hardness, friability, content uniformity, and dissolution profiles were compared with those of the reference brand, Crestor® (AstraZeneca).

Materials and methods

Materials

Brand (Crestor®, AstraZeneca) and Generic Iraqi-manufactured rosuvastatin products (Zerotin®, Sama Al-Fayhaa; Rosatin®, Awamedica; and Rosva®, Pioneer)

have been tested in this study alongside the corresponding APIs used in their manufacture. Products have been purchased from their appropriate sources (pharmacies or industries). Citrate buffer, Phosphoric acid, and acetonitrile were obtained from Sigma-Aldrich Co. (St. Louis, MO, USA). All chemicals used were of high-performance liquid chromatography (HPLC) grade, and deionized water was used in all preparations.

Methods

Hardness

Tablet hardness was assessed using a YD-2 Tablet Hardness Tester (Guoming, Beijing, China). Ten tablets from each product were tested to determine their mechanical strength, which is a critical quality attribute influencing tablet handling and patient administration [5,6].

Friability

The friability test was conducted using a CS-2 Friability Tester (Guoming, Beijing, China). Ten tablets from each product were placed in the friabilator drum and subjected to 100 rotations at a speed of 25 rpm. Afterward, the tablets were removed, dusted, and reweighed to assess weight loss. The results were compared to the USP acceptance limit of less than 1% [7,8].

Content Uniformity

To evaluate content uniformity, one randomly selected tablet (n = 10) from each product was dissolved in 100 mL of a diluent solution (25 mL acetonitrile and 75 mL water) to obtain a final concentration of 0.1 mg/mL. The solutions were filtered through 0.2 µm pore-size Whatman filters (G.E. Healthcare Life Science, Little Chalfont, UK) and analyzed using an HPLC system. The drug concentration was determined based on a calibration curve [6,9].

Dissolution

The test was carried out using an automated USP dissolution paddle apparatus, RC-1 Dissolution Tester (Guoming, Beijing, China). A single tablet (n=10) was placed in the vessel of the apparatus, which contained 900 mL of citrate buffer (CB) at pH 6.6, as specified in the USP product monograph [6], and maintained at a constant temperature of 37°C ± 0.2°C. Samples were withdrawn at various time intervals and were filtered through 0.2 µm pore-size Whatman filters (G.E. Healthcare Life Science, Little Chalfont, UK). A fresh dissolution medium was used to replace the withdrawn volumes. The collected dissolution samples were then analyzed using an HPLC system [6,10].

HPLC Analysis

All samples from the content uniformity and dissolution tests were analyzed using HPLC. The analysis was conducted with a reversed-phase C18 column (4 µm particle size) (Waters Nova-Pak C18, Framingham, MA, USA) and an Alliance HPLC system equipped with a photodiode-array (PDA) detector (Waters Nova, Framingham, MA, USA). The mobile phase consisted of acetonitrile, phosphoric acid, and water, at a flow rate of 1 mL/min and a detection wavelength of 242 nm.

Statistical Analysis

Data obtained from the various tests were statistically analyzed using Student's t-test to compare each generic product with the reference brand individually. Given the aim of the study, no statistical comparisons were made among the groups. Statistical analysis was performed using GraphPad Prism® software (La Jolla, CA, USA).

Results

Hardness

The mean tablet hardness for the rosuvastatin products ranged between 80 and 83 Newton (Fig. 1). Tablet hardness results from all generic products tested were comparable (not statistically significant, $p>0.05$) to the brand, Crestor®.

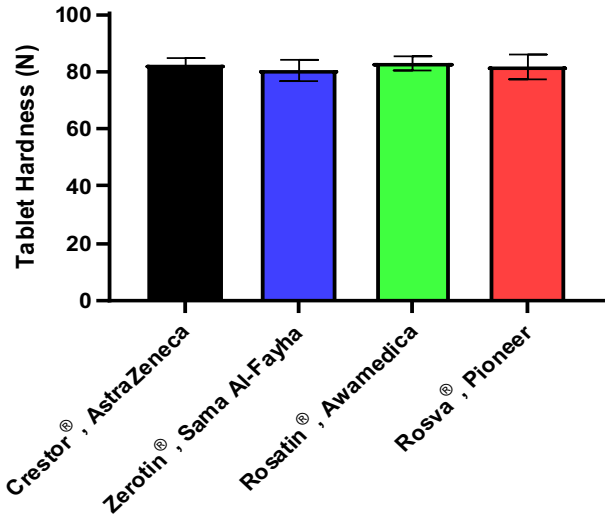

Figure 1. Tablet hardness (Mean ± SD) of Iraqi-manufactured generic rosuvastatin tablets and the brand (Crestor®, AstraZeneca). No statistically significant differences were found between each of the generic products and the brand.

Friability

No statistically significant differences were observed in friability between the generic products and their brand comparator, Crestor® (Fig. 2). All tablets from the various products met the USP friability requirement, remaining within the accepted limit of less than 1% [8].

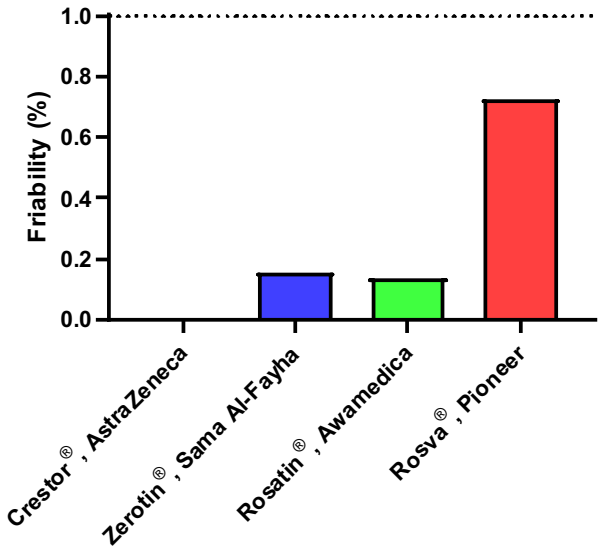

Figure 2. USP Friability (%) of Iraqi's manufactured generic rosuvastatin tablets and the brand (Crestor®, AstraZeneca). No statistically significant differences were found between each of the generic products and the brand.

Content Uniformity

The USP maximum allowed acceptance value (AV) to pass the content uniformity test is 15 [9]. All the products pass the test (Table 1).

Table 1. Content uniformity USP acceptance value of the Iraqi-manufactured generic rosuvastatin tablets and the brand (Crestor®, AstraZeneca).

Product	Percent Recovery	USP Acceptance Value
Crestor®, AstraZeneca	101.1	1.75
Zerotin®, Sama Al-Fayhaa	99.9	3.6
Rosatin®, Awamedica	97	2.25
Rosva®, Pioneer	101.1	2.4

Dissolution

All tablets dissolved instantly upon contact with the dissolution medium. The dissolution profiles of all tested products met the USP product monograph standards, achieving over 75% drug release within 30 minutes [10]. Moreover, the average time required for 75% of the drug to be released showed no statistically

significant differences between each of the generic products compared to the brand, Crestor® (Fig. 3).

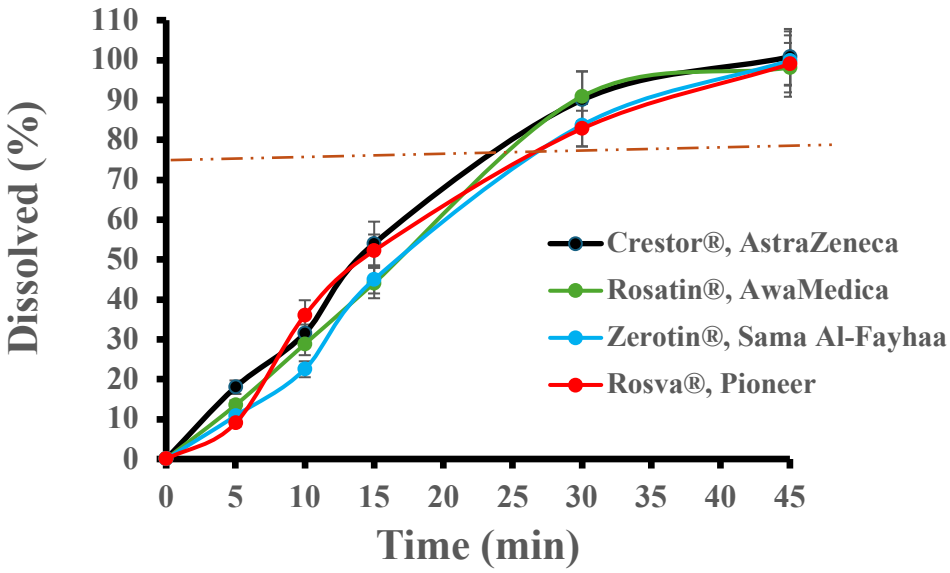

Figure 3. Mean ±SD of tablet dissolution of Iraqi-manufactured generic rosuvastatin tablets and the brand (Crestor®, AstraZeneca). At 30 min, no statistically significant differences were found between each of the generic products and the brand. All tested products met the USP product monograph standards, achieving over 75% drug release within 30 minutes.

Discussion

Hardness and friability tests were conducted to assess the physical durability of compressed tablets and their resistance to shipping and handling. These tests are essential to ensure that pharmaceutical tablets available in the market retain the necessary physical strength throughout transportation and storage. The tablet hardness tests results confirm that tablets produced in both countries meet USP criteria [8] with the Iraqi-manufactured generic products displaying hardness comparable to the brand, Crestor®. Friability tests revealed that all tested tablets from the different products remained within the USP limit of less than 1% weight loss [8]. The content uniformity test is conducted to ensure that the drug substance is evenly distributed among the dosage units within a batch and that the API

content in the sampled tablets complies with the USP product monograph standards. Content uniformity tests demonstrated that the drug content in all tested products complied with USP standards indicating that the accuracy and effectiveness of the packaging materials used by the manufacturers [9]. While hardness and friability are considered Critical Quality Attributes and are commonly assessed in quality control testing, their variation from the comparator brand is not critical as long as they do not negatively impact tablet dissolution and remain within the USP limits for friability and content uniformity [6]. As per USP guidelines, the dissolution test is conducted to evaluate the amount of API released and dissolved from the tested dosage unit, ensuring compliance with the specifications outlined in the USP product monograph [6,10]. The dissolution profiles of the generic tablets showed only minor, statistically insignificant differences, compared to the brand. Moreover, all products met USP criteria [10]. Since all brands were commercially available and intended for therapeutic use, these results support the USP dissolution criterion as a reliable indicator of therapeutic efficacy [5].

Conclusion

The three Iraqi-manufactured rosuvastatin generic products available in the Iraqi market demonstrated good quality and comparable performance to the reference brand, Crestor®. They are expected to exhibit similar bioavailability and therapeutic efficacy compared to Crestor®. Future research should expand the scope by evaluating additional pharmacological classes, various dosage forms, and long-term stability under USP-recommended storage conditions.

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