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A Review on Ultraviolet Spectrophotometric Determination of Rosuvastatin Calcium in Marketed Formulation

Ramnath Y. Lahare[1]*, Ashish N. Phuge[2], Ajit L. Gite[3] and Arjun K. Jadhav[3]
[1]Dept. of Quality Assurance Techniques, NDMVP Samaj's College of Pharmacy, Near K.T.H.M. Campus, Gangapur road, Nashik-422002, Maharashtra, India
[2]Dept. of Pharmaceutical chemistry, NDMVP Samaj's College of Pharmacy, Near K.T.H.M. Campus, Gangapur road, Nashik-422002, Maharashtra, India.
[3]Dept. of Pharmaceutics, NDMVP Samaj's College of Pharmacy, Near K.T.H.M. Campus, Gangapur road, Nashik-422002, Maharashtra, India
*Corresponding Author E-mail: ram.lahare2011@gmail.com

ABSTRACT

Three new simple, economic spectrophotometric methods were developed for quantitative estimation of Rosuvastatin Calcium in bulk formulation. First method includes determination of Rosuvastatin Calcium at absorption maxima 252 nm, second method applied was area under curve for analysis of Rosuvastatin Calcium in the wavelength range of 247-257 nm and third method was first order derivative. Beer law obeyed in the concentration range of 5-35 µg/ml for all three methods. The correlation coefficients were found to be 0.974, 0.982 and 0.982by absorption maxima, area under curve and first order derivative spectra. Results of analysis were validated statistically and by performing recovery studies. The mean percent recoveries were found satisfactory for all three methods. The percentage label claim was found in the range of 100.48% to 101.05%. The proposed method was validated statistically and recovery studies.

Keywords: Rosuvastatin Calcium,Absorption maxima method, Area under curve method, Derivative spectroscopy.

INTRODUCTION

The chemical name for Rosuvastatin calcium is bis [(E)-7-[4-(4-fluorophenyl)-6-isopropyl-2-[methyl(methylsulfonyl)amino]pyrimidin-5-yl](3R,5S)-3,5-dihydroxyhept-6-enoic acid] calcium salt. It is a lipid-lowering drug[1,2].It inhibits the enzyme 3-hydroxy-3-methyl glutaryl coenzyme A (HMG-CoA) reductase, the rate limiting enzyme that converts HMG-CoA to mevalonate a precursor of cholesterol and thereby checks the synthesis of cholesterol[1,2]. Extensive literature review reveals that several spectrophotometric, UV[3,4,5,6,7,8], HPLC[6,9,10,11,12] and HPTLC[13,14] methods have been reported so far for determination of Rosuvastatin Calcium alone and its combination with other drugs. Therefore, it was thought worthwhile to develop simple, accurate and reliable spectrophotometric method for estimation of Rosuvastatin Calcium in bulk and in tablet dosage form using methanol as a solvent. All the chemicals used were of analytical grade. Spectral and absorbance measurement were made on Shimadzu Double beam UV-Visible spectrophotometer 1800 with 10 mm matched quartz cells.

MATERIAL AND METHODS

Procurement of Drug Sample
Rosuvastatin Calcium was obtained from Emcure Pvt Lmt, Bhosari, Pune.

Reagents and chemicals used
Methanol-AR was used as solvent.

Instrument Used

Shimadzu UV-1800 double beam spectrophotometer with 1 cm path length supported by Shimadzu UV-Probe software, version 2.35 was used for all spectrophotometric estimations. Shimadzu balance (BL-220H) was used for all weighing.

Standard stock solution

Solution containing 100 μg/ml of pure drug was prepared by dissolving 10 mg of Rosuvastatin calcium in sufficient methanol to produce 100 ml solution in volumetric flask. From this aliquot solution was pipette out and diluted with methanol to obtained working standard stock solution of 100 μg/ml.

Analysis of the tablet formulation

Six tablets were accurately weighed and powdered. A portion of tablet powder equivalent to 100 mg of Rosuvastatin calcium was accurately weighed and transferred into a 100 ml volumetric flask and to this 25 ml of methanol added. The solution was Sonicated for 20 min and filtered through Whatman filter paper 41. The final volume was made up to 100 ml with methanolto obtained concentration of 1 mg/ml Rosuvastatin calcium. It was further diluted for the analysis, to obtained concentration in the range of 5-35 μg/ml. The results of the analysis of tablet formulation were found to be 100.48±0.29,101.38±0.015 and 101.05±0.02 for absorption maxima, area under curve method and first order derivative spectra respectively.

Recovery

A recovery study was carried out by addition of known amount of standard drug in the preanalysed tablet formulation, in 80%, 100% and 120% of label claim. At each level of amount three determinations were performed.
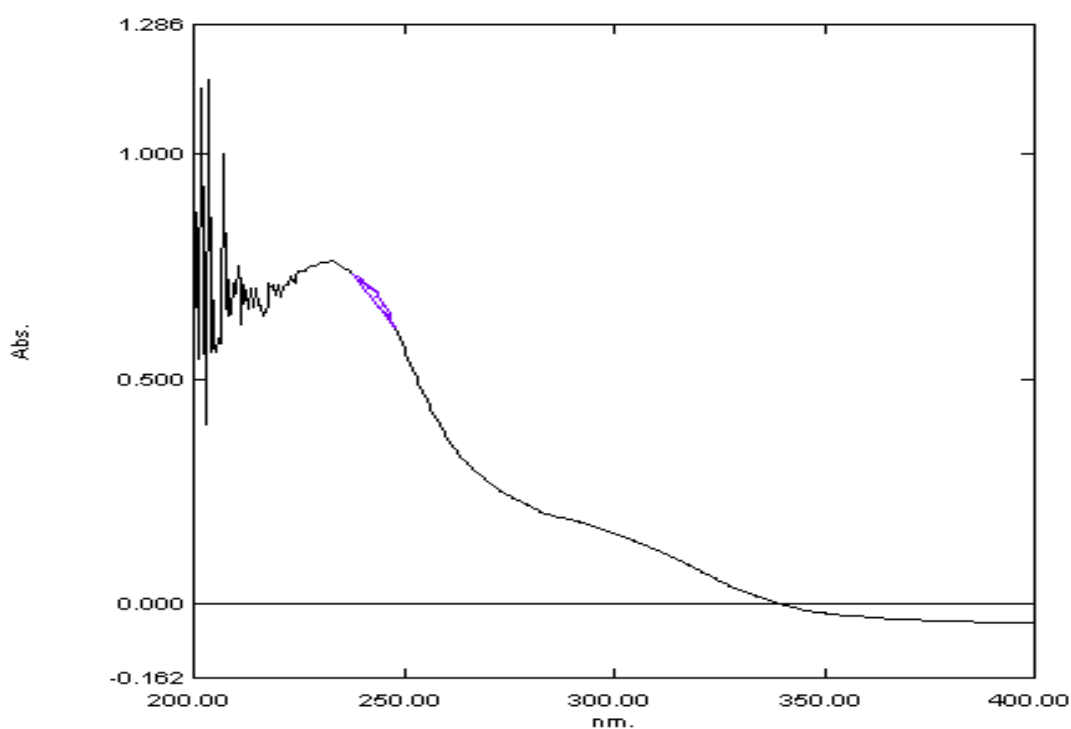
Method I: Absorption maxima method

For selection of analytical wavelength 10 μg/ml solution of Rosuvastatin calcium was prepared by appropriate dilution of standard stock solution and scanned in the spectrum mode from 400-200 nm. From the spectra λ_{max} of Rosuvastatin calcium252 nm was selected for the analysis (Figure 1 and Figure 2).The calibration curve was prepared in the concentration range of 5-35 μg/ml at 252 nm. By using calibration curve, the concentration of the sample solution was determined.

Fig. 1: Zero order UV-spectrum of Rosuvastatin Calcium
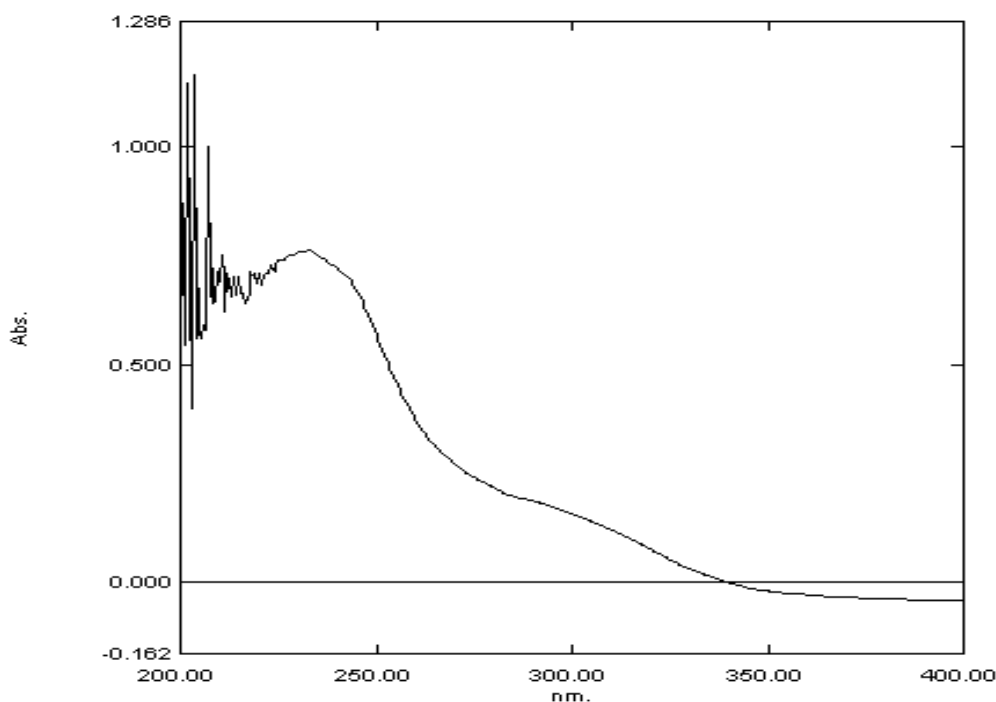
**Fig.2: Overlain Spectra of Rosuvastatin Calcium**
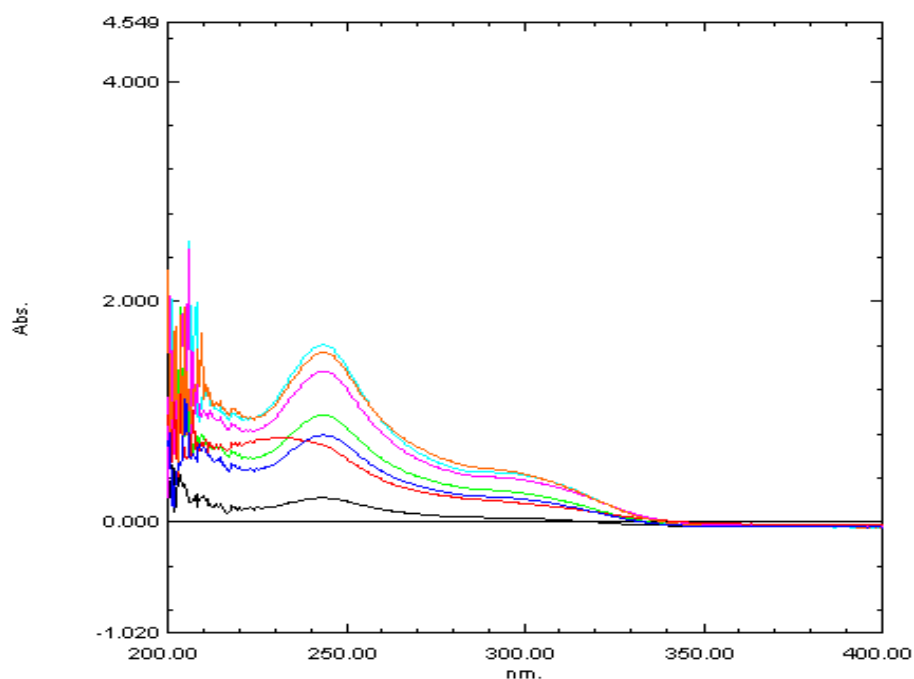
Method II: Area under curve method

For selection of analytical wavelength, 10 μg/ml solution of Rosuvastatin calcium was prepared by appropriate dilution of standard stock solution and scanned in the spectrum mode from 400-200 nm. From the spectra of drug, area under the curve in the range of 247-257 nm was selected for the analysis (Figure 3). The calibration curve was prepared in the concentration range of 5-35 μg/ml at their respective AUC range. By using calibration curve, the concentration of the sample solution can be determined.

Fig.3: Zero order UV-spectrum of area under curve method for Rosuvastatin Calcium

Method III: First order derivative spectroscopic method

In this method, 10 µg/ml solution of Rosuvastatin calcium was prepared by appropriate dilution of standard stock solution and scanned in the spectrum mode from 400-200 nm. The absorption spectra obtained was derivatized to first order derivative spectra. The first order derivative spectra show maxima and minima at 238 nm and 205 nm respectively (Figure 4). The absorption difference is calculated which was directly proportional to the concentration of the standard solution. The calibration curve for Rosuvastatin calcium was plotted in the concentration range of 5-35 µg/ml and scanned in the Second order derivative spectra. The calibration curve of $d^2A/d\lambda^2$ against concentration of drug showed linearity.

Fig.4: First order derivative Overlain Spectra of Rosuvastatin Calcium
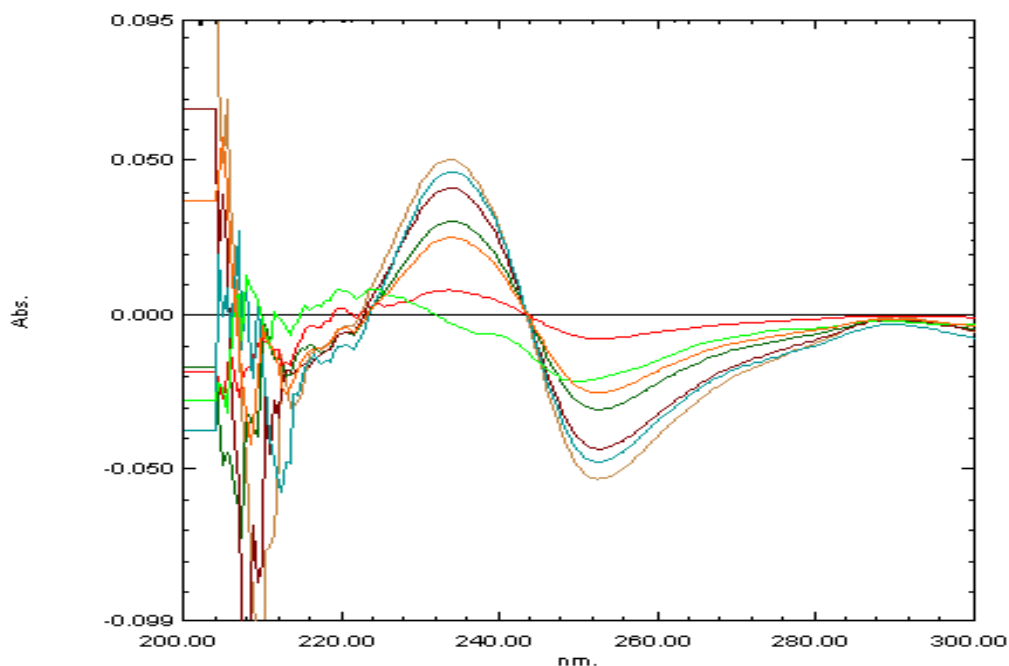
Method Validation

The proposed methods were validated as per ICH guidelines.[15, 16]

Linearity

From standard stock solution of 100 µg/ml of Rosuvastatin calcium 0.5, 1.0, 1.5, 2.0, 2.5, 3.0 & 3.5 ml were transferred into series of 10 ml volumetric flasks to obtain concentration range of 5 to 35 µg/ml for Rosuvastatin calcium (**Table 1**).

Table 1. Statistical parameters of linearity of Rosuvastatin calcium

Parameters	Absorption Maxima	Area Under Curve	First Order Derivative Spectroscopy
Beer's law range	5-35 µg/ml	5-35 µg/ml	5-35 µg/ml
Coefficient of Correlation (r^2)	0.974	0.982	0.982
Slope(m)	0.046	0.022	0.001
Intercept(c)	0.091	0.006	0.002

Y=mx+c

Accuracy and precision

Precision of the method was evaluated by using tablet powder equivalent to 100% of the label claim of Rosuvastatin calcium. Method repeatability was obtained from R.S.D. value by repeating assay of four replicates of single concentration three times in a same day.

Intermediate precision was assessed by assay of four replicates of single concentration of Rosuvastatin calcium on three consecutive days. The accuracy of the methods was assessed by recovery studies at three different levels, 80%, 100% and 120%. The values of standard deviation and recovery studies were found satisfactory (**Table 2**).

Table 2. Results of analysis of Rosuvastatin calcium in tablet formulation and recovery studies

Method	Label Claim mg/tab	% Label claim*	% Recovery*	S.D.	% RSD	SEM
Absorption Maxima	10 mg	100.48	99.80	±0.2949	0.2939	0.1296
Area Under Curve	10 mg	101.38	100.50	±0.0150	0.0147	0.0067
First Order Derivative	10 mg	101.05	102.92	±0.0200	0.0197	0.0089

*denotes n=4   CRESTOR-10 mg (Astra Zeneka Pharma Limited, Bangalore)

S.D. = Standard Deviation, %RSD = % Relative Standard Deviation, SEM = Standard Error of Mean

Limit of detection and limit of quantitation
The detection limit and quantitation limit was computed for lower limit of detection and minimum quantity of analyte measured and was found to be satisfactory by proposed spectrophotometric methods.

RESULTS AND DISCUSSION

The methods discussed in the present work provide a convenient and reliable way for quantitative determination of Rosuvastatin calciumin bulk and marketed formulation. Wavelengths of maximum absorbance for Rosuvastatin calcium 252 nm were selected for analysis by Absorption maxima method (Method I). In area under curve method (method II) quantitative determination was carried out at wavelength range 247-257 nm (For Rosuvastatin Calcium). In First order derivative spectroscopic method (method III) quantitative determination was carried out at wavelength range maxima and minima at 238 nm and 205 nm respectively (for Rosuvastatin Calcium). Linearity for Rosuvastatin Calcium was observed in the concentration range of 5- 35μg/ml for all three methods. The results of the analysis of tablet formulation were found to be 100.48±0.29,101.38±0.015 and 101.05±0.02 for absorption maxima, area under curve method and first order derivative spectra respectively. Percent drug found for in marketed formulation, by all three methods, was found in the range of 100.48 to 101.05%. Percent recovery for Rosuvastatin Calcium by all the methods was found in the range of 99.80 % to 102.92 % with standard deviation well below 2 indicating accuracy of the methods. Intra-day and Inter-day precision studies were carried out by analyzing marketed formulation, by all the methods, three times on the same day and on three different days, respectively. Standard deviation and coefficient of variance for intra-day and inter-day precision studies was satisfactorily low indicating high degree of precision and reproducibility of proposed methods.

CONCLUSION

The developed new three methods proved to be simple in procedure and it produced more accurate results. Hence all three methods effective for the routine analysis of Rosuvastatin calcium in bulk and tablet dosage form.

REFERENCES

1. Indian Pharmacopoeia, 6th edition, Government of India Ministry of Health and family welfare, published by the Indian pharmacopoeia commission, Ghaziabad, volume III, 2071 (2010)

2. Sweetman SC, Martindale -The complete drug Reference, 36th edn. Pharmaceutical press, London, 1389 (2009)

3. Gupta A, Mishra P, Shah K, Simple UV Spectrophotometric Determination of Rosuvastatin Calcium in Pure Form and in Pharmaceutical Formulations, *Eur J Chem.*, **6**: 89-92 (2009)

4. Sevda RR, Ravetkar AS, Shirote PJ, UV Spectrophotometric estimation of Rosuvastatin Calcium and Fenofibrate in bulk Drug and Dosage Form using Simultaneous Equation Method, *Int. J. ChemTech. Res.*, **3**: 629-635 (2011)

5. Afroz A, Haque T, Talukder MU, Ashraful Islam SM, Spectrophotometric Estimation of Rosuvastatin Calcium and Glimepiride in Tablet Dosage Form, *Asian j Pharm Ana.*, **1**: 74-78 (2011)

6. Karunakaran A, Subhash V, Chinthala R, Muthuvijayan J, Simultaneous Estimation of Rosuvastatin Calcium and Fenofibrate in Bulk and in Tablet Dosage Form by UV-Spectrophotometry and RP-HPLC, *Stamford J Pharm Sci.*, **4**: 58-63 (2011)

7. Mandwal PS, Patel PR, Agarwal KM, Surana SJ, Q-Absorbance and Multicomponent UV - Spectrophotometric Methods for Simultaneous Estimation of Rosuvastatin calcium and Fenofibrate in Pharmaceutical Formulation, *Der Pharmacia Lettre.,***4**: 1054-1059 (2012)

8. Uyar B, Celebier M, Altinoz S, Spectrophotometric determination of rosuvastatin calcium in tablets, Pharmazie., **62**: 411-413 (2007)

9. Kaila HO, Ambasana MA, Thakkar RS, Saravaia HT, Shah AK, A new improved RP-HPLC method for assay of rosuvastatin calcium in tablets, *Ind. J. Pharm. Sci.,***72**: 592–598 (2010)

10. Donthula S, Kumar MK, Teja GS, Kumar YK, Yasodha JK, Ramesh D, A new validated RP-HPLC method for determination of Rosuvastatin calcium in bulk and pharmaceutical dosage form, *Der Pharmacia Lettre.*, **3**: 350-356 (2011)

11. Tajane D, Raurale AM, Bharande PD, Mali AN, Gadkari AV, Bhosale VR, Development and validation of a RP-HPLC-PDA method for simultaneous determination of Rosuvastatin calcium and Amlodipine besylate in pharmaceutical dosage form, *J. Chem. Pharm. Res.*, **4**: 2789-2794 (2012)

12. Godavariya VD, Prajapati PB, Marolia BP, Shah SA, Development and validation of a RP-HPLC method for simultaneous estimation of Rosuvastatin calcium and Aspirin in marketed formulation, *Int. Res. J. Pharm.*, **3**: 173-175 (2012)

13. Devi SU, Latha EP, Guptha CVN, Ramalingam P, Development And Validation of HPTLC Method For Estimation of Rosuvastatin Calcium In Bulk And Pharmaceutical Dosage Forms, *Int. J. Pharm. Bio. Sci.*, **2**: 134-140 (2011)

14. Sharma MC, Sharmaa S, Kohlib DV, Sharma AD, A validated HPTLC method for determination of simultaneous estimation Rosuvastatin Calcium and Ezetimibe in pharmaceutical solid dosage form, *Arc. App. Sci. Res.*, **2**: 1-7(2010)

15. ICH, Q2A; Text on Validation of Analytical Procedure-October, International Conference on Harmonization, Geneva; 1-5 (1994)

16. ICH, Q2B; Validation of Analytical Procedures: Methodology-November, International Conference on Harmonization, Geneva; 1-8 (1996)