



Simultaneous Determination of Citalopram with NSAIDs in Bulk Drug, Pharmaceutical Dosage Forms, and Human Serum by Validated RP-HPLC Method

Saeeda Nadir Ali¹, Nida Naz^{2*}, Amtul Qayoom¹, Shumaila Akram³

¹Department of Chemistry, Faculty of Information Sciences and Humanities, NED University of Engineering, & Technology, Karachi, 75270, Pakistan

²Department of Applied Chemistry and Chemical Technology, Faculty of Sciences, University of Karachi, Karachi, 75270, Pakistan

³Department of Chemistry, Faculty of Sciences, University of Karachi, Karachi, 75270, Pakistan

INTRODUCTION

- Citalopram is a Potent Selective Serotonin Reuptake Inhibitor. Available as racemic mixture of S(+) and R(-) enantiomers, only S(+)-enantiomer is pharmacologically effective Racemic mixture [1].
- NSAIDs are clinically prescribed worldwide to provide relief against pain, fever, inflammation.
- It shows efficacy by inhibiting the activity of cyclooxygenase-1(COX-1) and cyclooxygenase-2(COX-2) enzymes in the body and thus prevents synthesis of prostaglandins [12].
- Previously reported methods for determination of citalopram are potentiometric determination [3], adsorptive square wave voltammetry (ASWV) [4], chemiluminescence [5], spectrophotometry [6], spectrofluorometry [7], micellar electrokinetic chromatographic method [8], HPTLC [9], LC-MS/MS [10] and HPLC [11].

PRESENT STUDY

- Simultaneous determination of Citalopram with NSAIDs.
- Study involves method development and validation.
- ICH guidelines have been followed for validation.
- Optimum reaction conditions for developed method have been established.
- Applicability of method is demonstrated by determining citalopram and NSAIDs in its active pharmaceutical ingredients, pharmaceutical formulation and human serum

EXPERIMENTAL AND RESULTS/DISCUSSION

Precision of Method											
Citalopram			Piroxicam			Celecoxib			Diclofenac sodium		
Conc. µg ml ⁻¹	RSD ^a (%)	RSD ^b (%)	Conc. µg ml ⁻¹	RSD ^a (%)	RSD ^b (%)	Conc. µg ml ⁻¹	RSD ^a (%)	RSD ^b (%)	Conc. µg ml ⁻¹	RSD ^a (%)	RSD ^b (%)
20	0.31	0.09	20	0.23	0.90	20	0.52	0.46	32	0.34	0.67
10	1.60	1.20	14	0.92	0.72	30	0.84	0.33	16	0.14	0.61
5	0.16	0.43	7	0.45	0.67	5	0.86	1.33	8.0	1.47	0.51
2.5	1.49	0.50	3.5	0.61	1.03	2.5	0.83	0.40	4.0	1.67	1.31
1.25	0.57	1.40	1.6	0.36	0.71	1.25	0.96	0.52	2.0	0.68	0.79
0.6	0.88	1.11	0.9	0.80	1.02	0.6	1.13	1.50	1.0	0.85	0.94

Human Serum											
Citalopram			Piroxicam			Celecoxib			Diclofenac sodium		
Conc. µg ml ⁻¹	%RSD	%RSD	Conc. µg ml ⁻¹	%RSD	%RSD	Conc. µg ml ⁻¹	%RSD	%RSD	Conc. µg ml ⁻¹	%RSD	%RSD
10	1.43	1.4	7.0	1.73	3.6	4.0	0.36	8.0	1.61	1.61	1.61
5	0.09	7	1.50	5	0.36	8.0	1.61	1.61	1.61	1.61	1.61
2.5	1.69	3.5	0.97	2.5	1.56	4.0	0.26	4.0	0.26	4.0	0.26

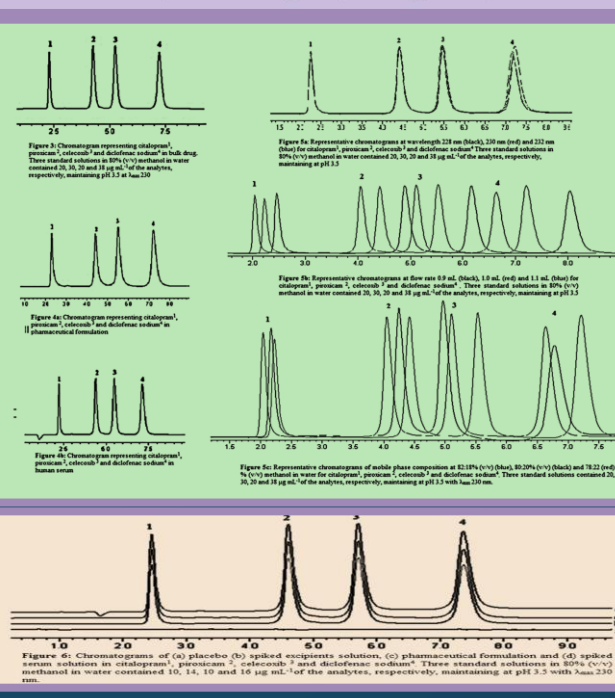
Recovery of Method											
Pramicid(20mg)			Feldene(10mg)			Cefazolin(100mg)			Diclofenac(50mg)		
Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error
10	99.64	-0.36	14	100.03	0.03	10	100.05	0.05	16	99.93	-0.07
5	100.86	0.85	7	99.68	-0.32	5	99.86	-0.14	8.0	100.28	0.28
2.5	99.73	-0.27	3.5	99.61	-0.39	2.5	100.54	0.54	4.0	100.36	0.35

Human Serum											
Citalopram			Piroxicam			Celecoxib			Diclofenac sod		
Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error	Conc. µg ml ⁻¹	%Rec	%Error
10	98.54	-1.46	14	99.43	-0.570	10	100.87	0.860	16	98.54	-1.46
5	98.63	-1.390	7	98.45	-1.575	5	99.89	-0.114	8.0	98.08	-1.961
2.5	101.07	1.060	3.5	98.25	-1.782	2.5	99.47	-0.531	4.0	100.79	0.786

Regression characteristics				
Parameters	Citalopram	Piroxicam	Celecoxib	Diclofenac sod
Slope	1843.8	2200.1	3795.8	2257.3
Linearity (µg ml ⁻¹)	0.6-20	0.9-28	0.6-20	1.0-32
Intercept	1665.2	5579	2428.9	2927
Correlation coefficient	0.9999	0.9988	0.9983	0.9984
Standard error	0.1312	0.4769	0.3558	0.6585
Standard error estimate	0.2036	0.8954	0.6934	1.2808
LOD (µg ml ⁻¹)	16.45	23.33	27.66	14.44
LOQ (µg ml ⁻¹)	0.04986	0.07071	0.08383	0.04386

System Suitability of Method				
Drugs	t _R ^a	N ^b	T ^c	Res ^d
Citalopram	2.3	2510	1.533	0.00
Piroxicam	4.4	4244	1.326	9.619
Celecoxib	5.4	5192	1.203	3.834
Diclofenac sod	7.2	5809	1.178	4.884

^aRetention time, ^bTheoretical plates, ^cTailing factor, ^dResolution



CONCLUSION

- The assay defined herein for simultaneous liquid chromatographic method with UV detection determination of citalopram with NSAIDs in bulk drug, pharmaceutical formulation and human serum.
- The method was found to be reliable, sensitive, specific and robust and showed satisfactory linearity and accuracy for all the studied analytes.
- Based on validation and applicability, it is concluded that the method is well suited and meets the need for routine analysis of studied analytes as well as for laboratory applications.

REFERENCES

1. Lodi, J., Pradeep, P. & Nema, J. (2021). Rapid determination of citalopram in human plasma by high-performance liquid chromatography. *Journal of Chromatography B: Biomedical Sciences and Applications*, 155: 270-285.

2. J. Rodriguez, G. Castañeda, and L. Mateo. Rapid determination of ibuprofen, citalopram and their metabolites by high performance liquid chromatography-fluorescence detection in urine. *Method validation and application to real samples*. *J. Chromatography B: Biomedical Sciences and Applications*, 155: 270-285 (2021).

3. I. A. El, G. E. Mohamed and A. A. Nageeb. A New Screen-printed Electrode for Determination of Citalopram Hydrobromide in Pharmaceutical Formulation. *Chin. J. Anal. Chem.*, 42, 585-592 (2014).

4. M. Ghosh, A. Ghosh, T. Mukherjee and P. Chakrabarti. Construction of novel sensitive electrochemical sensor for electro-oxidation and determination of citalopram based on zinc oxide nanoparticles and multi-walled carbon nanotubes. *Anal. Sci. Eng. & Technol.*, 42, 847-854 (2018).

5. M. K. Khan, R. E. Sam, J. Ghosh and S. K. Das. A validated spectrophotometric method for the determination of citalopram in bulk and pharmaceutical preparations based on the measurement of the silver nanoparticles-enhanced fluorescence of citalopram/barbitone complex. *J. Fluorim.*, 23, 80-88 (2013).

6. J. Rodriguez, J. Garcia, A. C. Garcia, M. J. J. Lopez, M. J. Fernandez. HPLC method for Simultaneous Determination of Citalopram Hydrobromide and its Precursor Citalopram in Human Urine. *J. Chromatography B*, 105, 289-295 (2013).

7. S. C. Saravanan, M. Chandrasekar, C. S. S. Kumar, C. Subudhar, B. Rajesh and G. S. Kumar. A novel and rapid HPLC method for the analysis of citalopram hydrobromide in tablet dosage form - development and validation. *J. Adv. Sci. Res.*, 12, 82-84 (2012).

8. P. P. Mendonca. Analysis of citalopram in plasma and hair by a validated LC-MS/MS method. *J. Chromatography Sep. Tech. B*, (2016).

9. H. H. Jiang, J. N. Chen, F. J. Yu, F. H. Yu, W. Yang, M. Ding, Y. H. Jiang and B. Han. Use of Selective Serotonin Reuptake Inhibitors and Hair of Upper Gastrointestinal Bleeding: A Systematic Review and Meta-analysis. *Chin. J. Geriatrics*, 34(12), 1027-1033 (2013).

10. V. K. Lohar, A. N. Srinivas and S. Singh. Meta-analysis