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FORMULATION AND COMPARATIVE DISSOLUTION STUDY OF ILAPRAZOLE ENTERIC COATED TABLETS WITH A REFERENCE PRODUCT

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ABSTRACT

Ilaprazole is a Proton Pump Inhibitor (PPI), an anti-acidic drug used in the treatment of dyspepsia, peptic and duodenal ulcer diseases, and gastro-esophageal reflux disease (GERD). Ilaprazole at oral doses of 10 mg has shown higher suppression of gastric acid secretion and more prolonged plasma half-life, and similar safety compared to 20 mg omeprazole. However, Ilaprazole is a class II drug as per BCS (Biopharmaceutical Classification System) which means it has a low aqueous solubility and high permeability. It is of utmost importance to understand the release profiles of such drugs to relate with the in vivo availability. Hence, the study was developed to compare the *in vitro* dissolution profiles of Ilaprazole enteric coated tablets (Ilatop-10) with a Reference product available in Nepalese market (Lupila 10) by applying bio-relevant medium (pH 1.2 and 6.8 buffers). *In vitro* dissolution profiles were evaluated in bio-relevant medium in dissolution apparatus and the dissolution curves were compared by the similarity factor (f2). The dissolution profiles of the test and the reference products demonstrated similar disposition in both bio-relevant media. Therefore, dissolution profiles in bio-relevant media in dissolution apparatus may be used as a tool to predict and correlate *in vivo* disposition of formulations of Ilaprazole. Furthermore, it can be argued that bio-waiver can be granted for enteric coated tablets of Ilaprazole on the basis of *in vitro* dissolution profile.

KEYWORDS: *Ilaprazole, enteric coated tablets, BCS, dissolution profile.*

1. INTRODUCTION

Ilaprazole, a proton pump inhibitor (PPI), is a newly developed medicine in the management of acid-related disorders. Several studies have shown that Ilaprazole is a highly effective and safe PPI compared with other PPIs in the treatment of duodenal ulcer. Ilaprazole can be recommended as a therapy for acid related disorders, especially in Asian populations.

Duodenal ulcer is a very common digestive disease with a high incidence all over the world.[1, 2, 3]

As the first proton pump inhibitor (PPI), Omeprazole has been used therapeutically for many years, and shown great efficacy in treating peptic ulcers.[4, 5, 6] Currently, research is focused on more effective PPIs with a lower dose and comparative safety.[7, 8]

Ilaprazole (also known as IY-81149), the latest proton pump inhibitor (PPI) has been less well reported in clinical practice, as a newly developed medicine in the management of acid related disorders.[9, 10]

Extended-release dosage forms are designed to achieve a prolonged therapeutic effect by continuously releasing medication over an extended period of time after administration of a single dose. The objective in formulating an extended release dosage form is to be able to provide a similar blood level pattern for up to 12 hours after oral administration of the drug. The basic goal of therapy is to achieve a steady-state blood or tissue level that is therapeutically effective and nontoxic. The design of proper dosage regimens is an important element in accomplishing this goal. This is usually accomplished by maximizing drug availability, i.e., by attempting to attain a maximum rate and extent of drug absorption; however, control of drug action through formulation also implies controlling bioavailability to reduce drug absorption rates.[11]

Ilaprazole is a BCS Class-II drug with low aqueous solubility and high permeability which requires a bioequivalence study to correlate with in vivo availability. Therefore, in this research, a comparative study of *in vitro* dissolution profiles of test product (Ilatop-10) and a reference product was carried out to confirm their similarity in release pattern.

Ilaprazole (IPZ) is a proton pump inhibitor which is chemically {2-[[(4-methoxy-3-methyl)-2-pyridinyl] methylsulfinyl-5-(1Hpyrrol- 1-yl)-1H-benzimidazole.The chemical structure of the drug is shown in Figure 1.

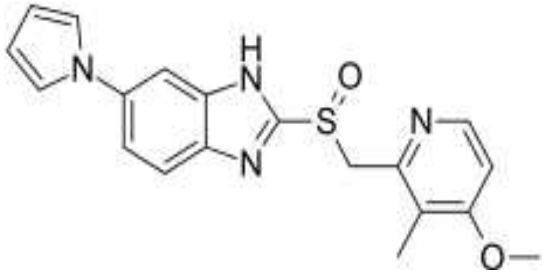

Figure 1: Chemical structure of Ilaprazole (IPZ).

2. MATERIALS AND METHODS

2.1 MATERIALS

The pure Ilaprazole raw material was received from Metrochem API Pvt. Ltd, Telangana, India. Other excipients used during formulation of test product were Mannitol, Light Magnesium Oxide, Sodium Starch Glycollate, Croscarmellose sodium, PVPK-30, Kyron T-314, Purified talc, and Magnesium Stearate. Similarly, Hydroxypropylmethyl cellulose phthalate (HPMC-P) was used as a coating agent.

2.2 METHODS

2.2.1 Dissolution Test

In Acid Medium

Apparatus used: Dissolution Test Apparatus Type I (Paddle)

Medium: 1000ml of 1.2pH HCl

Speed and Time: 100 rpm and 120 minutes

1000ml of dissolution medium was introduced into the vessel of apparatus. Then, the dissolution medium was warmed to 36.5 °C- 37.5°C. Now, one tablet was placed in each vessel and the apparatus was run for destined time. A suitable volume of sample was withdrawn and filtered. The absorbance was measured at 220 nm using 1.2 pH HCl as blank. The percentage release of Ilaprazole in acid medium was finally calculated**.**

Standard Preparation

About 28 mg of working standard of Ilaprazole was weighed accurately and transferred into a 100ml of volumetric flask. It was dissolved with 1.2 pH HCl and the volume was made up to 100 ml with the same medium. 2 ml of this solution was pipette out and transferred into 50 ml volumetric flask and the volume was made up to 50 ml with 1.2pH HCl.

$$\%\ Release = \frac{Abrobance\ of\ test}{Absorbance\ of\ standard} x \frac{weight\ of\ standard\ (mg)}{Standard\ dilution} x \frac{Sample\ dilution}{Label\ claim} x \frac{Potency}{100} x100$$

The required specification of release is that not more than 10 % of the stated amount.

In Buffer Medium
Apparatus: Dissolution Test Apparatus Type I (Paddle)
Medium: 1000ml of pH 6.8 buffer
Speed and Time: 100 rpm and 45 minutes

1000ml of dissolution medium was introduced into the vessel of apparatus. Then, the dissolution medium was warmed to 36.5 °C- 37.5°C. Now, one tablet was placed in each vessel and the apparatus was run for destined time. A suitable volume of sample was withdrawn and filtered. The absorbance was measured at 220 nm using 6.8 pH buffer as blank. The percentage release of Ilaprazole in buffer medium was finally calculated**.**

About 28 mg of working standard of Ilaprazole was weighed accurately and transferred into a 50ml of volumetric flask. It was dissolved with methanol and the volume was made up to 50 ml with methanol. 2 ml of this solution was pipette out and transferred into 100 ml volumetric flask and the volume was made up to 100 ml with 6.8 pH buffer.

2.2.2 SIMILARITY FACTOR

The similarity factor (f2) is a logarithmic reciprocal square root transformation of sum of squared error and is a measurement of the similarity in the percent (%) dissolution between the two curves.

$$f_2 = 50 \times \log \{[1 + (1/n) \Sigma_{t=1}^{n} (R-T)^2]^{-0.5} \times 100$$

Where n is the number of time points, R is the dissolution value of the reference (prechange) batch at time t, and T is the dissolution value of the test (postchange) batch at time t.

Experimental data were analyzed through an independent approach using the similarity factor (f2)[12] to compare the dissolution profiles. Curves were considered similar if f2 values were between 50 and 100.

3. RESULTS AND DISCUSSION

3.1 MEDIUM I (pH 1.2 HCl)

3.1.1 Test Product Dissolution Data in Medium-I

Table 1: Cumulative percentage drug released (test) in pH 1.2 HCl.

S. No.	CUMULATIVE PERCENTAGE DRUG RELEASED (TEST: ILATOP 10 PRODUCT)
	Time point 1 (120 min)
1	5.256
2	7.858
3	3.772
4	4.588
5	5.653
6	4.002
7	7.503
8	5.622
9	5.946
10	5.455
11	6.667
12	6.103
MIN	**3.772**
MAX	**7.858**
AVERAGE	**5.702**
SD	**1.249**

3.1.2 Reference Product Dissolution Data in Medium-I

Table 2: Cumulative percentage drug released (Reference) in pH 1.2 HCl.

S. No.	CUMULATIVE PERCENTAGE DRUG RELEASED (REFERENCE PRODUCT: Lupila 10)
	Time point 1 (120 min)
1	1.835
2	2.951
3	1.824
4	2.586
5	2.232
6	0.934
7	9.273
8	3.670
9	4.583
10	4.347
11	8.285
12	6.482
MIN	**0.934**
MAX	**9.273**
AVERAGE	**4.084**
SD	**2.660**

From Table 1 and 2, it is clear that drug release of both test and reference products in 1.2 pH for 120 minutes is below 10% which complies with the Pharmacopoeial requirement for the enteric coated tablets in acidic pH.

Similarity Factor (f2 calculation): 94.53

Graphical representation

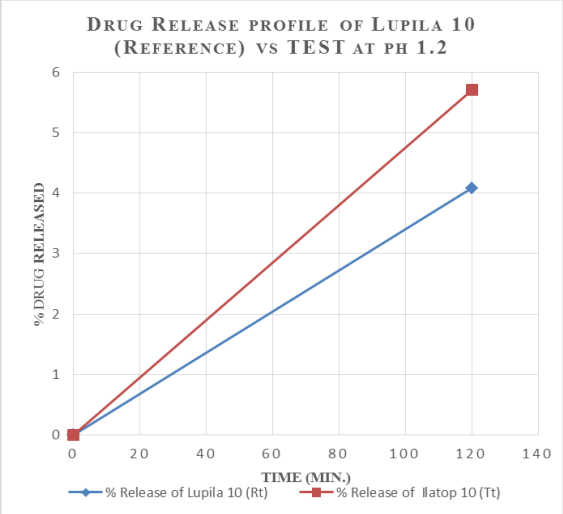

Figure 2: Drug release profile of Reference Product (Lupila 10) vs. Test (Ilatop-10) at pH 1.2

Figure 2 demonstrates that the similarity factor of drug release profile of reference vs. test product at pH 1.2 is 94.53 showing similar pattern of release.

3.2 Medium II (pH 6.8 buffer)

3.2.1 Test Product Dissolution Data in Medium-II

Table 3: Cumulative percentage drug released (Test Product) in pH 6.8 buffer.

S. No.	CUMULATIVE PERCENTAGE DRUG RELEASED (TEST PRODUCT)			
	Time point 1 (10 min)	Time point 2 (20 min)	Time point 3 (30 min)	Time point 4 (45 min)
1	24.094	47.569	61.067	60.950
2	27.947	45.210	64.745	67.675
3	22.802	48.110	74.054	68.087
4	17.326	48.327	68.452	66.082
5	29.954	43.354	65.184	72.931
6	22.407	44.284	65.568	63.263
7	27.115	53.410	61.997	68.935
8	26.955	46.053	66.142	71.127
9	28.086	43.343	65.760	67.461
10	28.353	52.858	62.055	66.406
11	24.201	47.197	64.394	63.549

12	28.919	45.562	69.147	72.559
MIN	**17.326**	**43.343**	**61.067**	**60.950**
MAX	**29.954**	**53.410**	**74.054**	**72.931**
AVERAGE	**25.680**	**47.106**	**65.714**	**67.420**
% RSD	**3.618**	**3.287**	**3.578**	**3.696**

3.2.2 Reference Product Dissolution Data in Medium-II

Table 4: Cumulative percentage drug released (Reference Product) in pH 6.8 buffer.

S. No.	CUMULATIVE PERCENTAGE DRUG RELEASED (REFERENCE PRODUCT: Lupila 10)			
	Time point 1 (10 min)	Time point 2 (20 min)	Time point 3 (30 min)	Time point 4 (45 min)
1	19.261	40.398	68.638	66.128
2	25.507	55.339	70.749	67.031
3	19.054	31.716	61.894	66.303
4	23.574	37.523	63.990	68.694
5	23.030	37.919	63.462	68.134
6	21.477	41.965	74.490	67.442
7	26.083	42.559	64.697	70.603
8	20.336	40.627	61.525	69.221
9	25.746	34.006	62.332	71.685
10	25.529	47.224	63.728	68.626
11	17.512	52.817	63.910	67.227
12	15.263	43.732	62.788	70.669
MIN	**15.263**	**31.716**	**61.525**	**66.128**
MAX	**26.083**	**55.339**	**74.490**	**71.685**
AVERAGE	**21.864**	**42.152**	**65.183**	**68.480**
% RSD	**3.612**	**6.981**	**4.000**	**1.792**

Similarity Factor (f2 calculation): 73.90

Graphical representation

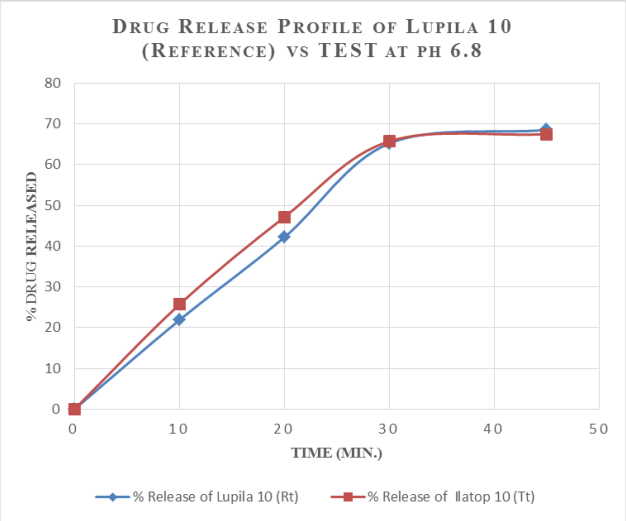

Figure 3: Drug release profile of Reference Product (Lupila 10) vs. Test (Ilatop-10) at pH 6.8.

Figure 3 demonstrates that the similarity factor of reference vs. test products at pH 6.8 is 73.90 which show they both have acceptable and similar release patterns.

4. CONCLUSION

The similarity factor (f2) between reference product and test product was found to be 94.53 and 73.90 in dissolution medium of pH 1.2 and pH 6.8, respectively which lies within the required range of above 50. Therefore, it can be argued that bio-waiver can be granted for enteric coated formulations of Ilaprazole on the basis of *in vitro* dissolution profile.

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6. CONFLICT OF INTEREST

The author declares no conflict of interest and no third party funding in this study.

7. REFERENCES

1. Lam SK. Differences in peptic ulcer between East and West. Bailliere Best Pract Res clin Gastroenterol, 2000; 14: 41-52.
2. Lan JY, Barkun A, Fan DM, Kuipers EJ, Yang YS, Chan FK. Challenges in the management of acute peptic ulcer bleeding. Lancet, 2013; 381: 2033-2043.
3. Najm WI. Peptic ulcer disease. Prim Care, 2011; 38: 383-394.
4. Malfertheiner P, Chan FK, McColl KE. Peptic ulcer disease. Lancet, 2009; 374: 1449-1461.
5. Leong RW. Differences in peptic ulcer between the East and the West. Gastroenterol Clin North Am, 2009; 38: 363-379.
6. Pilotto A, Franceschi M, Maggi S, Addante F, Sancarlo D. Optimal management of peptic ulcer disease in the elderly. Drugs Aging, 2010; 27: 545-558.
7. Bohidar NP, Krishna K, Panda BK, Patel C. Ilaprazole: Is this a superior proton pump inhibitor for duodenal ulcer? Trop Gastroenterol, 2013; 34: 95-98.
8. Rotman SR, Bishop TF. Proton pump inhibitor use in the U.S. ambulatory setting, 2002-2009. PLOS One, 2013; 8: e56060.

9. De Bortoli N, Martinucci I, Giacchino M, Blandizzi C, Marchi S, Savarino V, Savarino E. The pharmacokinetics of Ilaprazole for gastro- esophageal reflux treatment. Expert Opin Drug Metab Toxicol, 2013; 9: 1361- 1369.
10. DU YQ, Guo WY, Zou DW, Zhan XB, Li Z, Hu JH, Gong YF, He J, Lu JP, Li ZS. Acid inhibition effect of Ilaprazole on Helicobacter pylori- negative healthy volunteers: an open randomized cross- over study. J Dig Dis., 2012; 13: 113-119.
11. Lachman L, Lieberman HA, Kanig JL. The theory and practice of industrial pharmacy (3rd ed.). Varghese Publishing House, Mumbai, 1987; 430-432.
12. Shah VP, Tsong Y, Sathe P, Liu JP. In vitro dissolution profile comparison statistics and analysis of the similarity factor, f2. Pharm Res., 1998; 15: 889-96.