

Comparative Physicochemical Analysis of Two Brands of Imipramine

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ABSTRACT

A renowned medicine called imipramine is used to manage psychiatric disorders, primarily depression. It is a novel therapy that works marvels but also has troublesome side effects. When we discuss veteran medications that have multiple applications in various domains and are formulated by multiple brands, we naturally become intrigued by which brand provides better formulation. Here we compare the two brands of imipramine, namely Tofranil and Imidol and their physicochemical characteristics are being evaluated.

Keywords: Imipramine, brand, Tofranil, Imidol, physicochemical properties.

INTRODUCTION

Imipramine is not a new name; in fact, it is a household name. It was the first medication in the TCA family^{1,2}, and it is one of those medicines whose impact is not restricted to specific actions, but has a wide range of implications on bodily functions. It is primarily used owing to its antihistaminic properties, but it is eminent for inhibiting neuronal reuptake of the neurotransmitter's serotonin, norepinephrine, and dopamine^{2,3}. To a certain extent, it also has alpha-adrenergic effects and anticholinergic properties.

Thus, a list of imipramine's applications includes managing psychosomatic disorders, notably the chronic form of depression, by improving mood, sleeping habits, appetite, and cognitive function and aids in reviving interest in life and elevating neurotransmitters. It also works efficiently in managing anxiety, panic disorder, OCD, and PTSD⁴. Imipramine mechanism of action in addressing children's nocturnal enuresis is unclear⁵.

Consequently, after acknowledging its feat as a mood stimulant, it should be outlined that it is not a freelance medicine; rather, it is available only with a prescription by the healthcare provider and may have detrimental effects by boosting the amounts of certain biological substances in the brain. Patients who initiated imipramine therapy should be closely monitored for clinical deterioration, suicidal thoughts, and bizarre behavior shifts, as it has

many troublesome consequences. Some of the adverse effects include mild gastrointestinal changes, neuropsychiatric problems, Serotonin syndrome and cardiovascular consequences. The most challenging side effects of imipramine are due to its antihistaminic and anticholinergic effects. Moreover, it also causes photosensitivity⁶.

Imipramine is available in oral dosage forms and to determine which of the two imipramine brands Tofranil and Imidol, is superior to the other, we are assessing their physicochemical properties.

MATERIALS AND METHODS

To conduct a comparative physicochemical investigation, two brands of imipramine (25 mg) tablets Tofranil and Imidol that are sold commercially were acquired. The study was conducted in July 2023 in the Research Laboratory at the Jinnah University for Women's Faculty of Pharmacy. To carry out a comparison analysis, the following parameters were examined:

Weight Variation Test

To carry out the weight variation test 20 tablets from each brand were selected and weighed on FX-400 electronic balance. Their weight variation was observed compared to the BP/USP norm, which states that NMT 2 tablets out of 20 should exceed the $\pm 10\%$ deviation⁷. The purpose of the test is to guarantee the homogeneity of the dosage form. The formula below was also used to calculate the upper and lower control limits:

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For upper control limit = Mean + 3x standard deviation

For lower control limit = Mean – 3x standard deviation

Thickness Test

A dimensional variable associated with the tablet's compression process is its thickness. This relates to the level of compaction. The thickness test was performed by taking 10 tablets from each brand and measuring them with a Vernier caliper⁸.

Hardness Test

The hardness of a tablet is the amount of force or mechanical strength that the tablet can withstand. With the Galvano Scientific MH-1 hardness tester, we determined the hardness of imipramine by selecting a set of 10 tablets of each brand. This test was employed to calculate the tablet's strength by putting it under mechanical stress. To withstand NLT 4kg of force, the tablet needs to be sufficiently durable⁹.

Friability Test

Tablets tend to chip, which eventually detracts from their elegant design, which has a significant impact on the weight and content uniformity of the tablet. The percentage weight loss of powder from the tablet surface due to mechanical action is known as the tablet's friability. On a Roche friability tester, 10 tablets of each brand were taken and subjected to 100 revolutions at 25 rpm, in 4 minutes. The USP states that the friability test should not deviate by more than 1%¹⁰.

Disintegration Test

This is a qualitative test that is performed to assess whether oral solid dosage forms, such as tablets, will break down within a specified time when exposed to a liquid under the given set of conditions. For uncoated tablets, USP stipulates they should dissolve in 15 minutes. If one or two tablets do not fulfill the specifications, then the test must be repeated on the other 12 tablets, of which 16 out of 18 tablets should dissolve in allotted time to pass the test. Employing the disintegration assembly the DS-0702, which contains two baskets holding six cylindrically perforated tubes, each tablet, was inserted into one of the six tubes. Using water as the medium for the disintegration test, the tablets were observed until they fell apart completely.

RESULTS AND DISCUSSION

The purpose of the current study was to compare two imipramine brands that are sold commercially in Karachi, Pakistan. The brands were assessed using the BP/USP's stipulated limitations.

The average weight, thickness, and hardness of imipramine brands are displayed in Table 1. Each brand's average weight did not differ from the 7.5% pharmacopoeial specified limit. In an analogous way, both thickness and hardness also met official pharmacopoeial standards.

Table 1. Statistical analysis of Tofranil and Imidol; standard deviation (STD), upper control limit (UCL) and lower control limit (LCL).

Test Parameters	Tofranil	Imidol
Average Weight (g)	76.375	140.650
STD	2.975	6.879
UCL	85.285	161.287
LCL	67.465	120.013
Average Thickness (mm)	5.2	6.3
STD	0.421	0.483
UCL	6.463	7.749
LCL	3.937	4.851
Average Hardness (Kg)	1.850	2.560
STD	0.186	0.497
UCL	2.408	4.051
LCL	1.292	1.069

The physicochemical test findings, when statistically analyzed, showed slight differences between each brand. It was found that Imidol shows the highest stability in the friability test as compared to Tofranil. Both brands comply with BP/USP criteria. This test determines the impact of attrition and tumbling; it is necessary to calculate the maximum extent to which imipramine tablets may shatter when rotating in a drum.

Table 2. Results of friability and disintegration tests.

Tests	Acceptance criteria	Results	
Friability (%)	NMT 1%	Tofranil	Imidol
		0.145	0.219
Disintegration (Min)	NMT 15 min	6	5

A drug's disintegration and dissolution pattern are the main factors affecting its performance in a powder compact. The disintegration process is particularly important since it maximizes and ensures the API's bioavailability from most solid dosage forms. The imipramine brands Tofranil and Imidol had a respective disintegration time of 6 and 5 minutes. The findings showed that all the imipramine tablets of these two brands fall within the range specified by the BP/USP guidelines, which is no more than 15 minutes for immediate-release tablets. Imidol is marginally better than Tofranil as it shows rapid disruption of the tablet core followed by the loss of structural integrity.

CONCLUSION

Tofranil and Imidol are the effective brands of imipramine. The active ingredient's therapeutic activity is significantly influenced by the quality of the dose forms. The findings of this particular investigation reveal that both products adhere to the established pharmacopoeial limits but Imidol showcases better performance than Tofranil hence, surpassing the Tofranil.

LIMITATIONS

The limitations of this study stem from the fact that the only quality of two imipramine brands are being assessed based on their physiochemical characteristics, rather than quantifying them using pharmacological landmarks.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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