

Evaluation of quality parameters of metronidazole 400mg tablet

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ABSTRACT

The Metronidazole market has experienced substantial growth in recent times. The global Metronidazole market was valued at USD 114.5 million in 2019 and is expected to reach USD 110.5 million by the end of 2026, growing at a CAGR of -0.5% during 2021-2026. The purpose of the study was to assess the quality of different brands of metronidazole tablets. Our study mainly focused on the Evaluation of the tablets. Comparative study of metronidazole tablets of same strength of different brands were carried out. Results were found satisfactory. All the samples were within the Pharmacopoeial limit. The study on Metronidazole tablets was performed in our lab. The tablets obtained from Abbott Healthcare Pvt. Ltd found to be better than Danish Healthcare Pvt. Ltd. and JB Chemicals and Pharmaceutics.

Key Words: Metronidazole tablets, Diarrhoea, Quality testing, comparative study

I. INTRODUCTION

Metronidazole is a nitroimidazole derivative, classified as tissue and luminal amebicides. It is effective against protozoal infestations and bacterial infections^[1]. The International Union of Pure and Applied Chemistry name for metronidazole is 2-(2-methyl-5-nitro-1H-imidazol-1-yl) ethan-1-ol, having molecular formula $C_6H_9N_3O_3$, molecular mass 171.15g/mol, while the melting point is 159-163°C. It has been used for the treatment of infections for more than 45 years and is still in use for the treatment of amoebiasis, giardiasis, infections during pregnancy, bacterial vaginosis and prophylaxis against anaerobic infection after bowel surgery, wound abscess, antibiotic-associated colitis against *Helicobacter pylori* and *Giardia lamblia* that can cause travelling diarrhoea^[2,3].

However, the chances of the development of clinically drug-resistant strains of *Helicobacter pylori* leading to gastro intestinal GI cancer may increase by over using metronidazole for the treatment of parasitic infections. When metronidazole is administered, it inhibits nucleic

acid synthesis by disrupting the DNA of microbial cells^[4,5]. Metronidazole is well tolerated and safe antibiotic, as it does not cause any serious adverse effects^[6].

Metronidazole is available in different formulations of suspension, tablets, creams and infusion which tablets is widely prescribed products in health care settings (Gilbert et al, 1987)^[7]. Metronidazole can be administered through different routes like rectal, topical, intravenous, oral and vaginal having different bioavailability percentages, i.e. 80% (oral), 60%-80% (rectal), 20%-25% (vaginal). It is metabolized by liver, excreted through urine, having biological half life for 8 h^[8].

Some of the complicating factors that affect the quality of the drug products are related to the quantity of active pharmaceutical ingredient (API) which mismatches with the label claim or occasionally no API, unwanted excipient and impurity content^[9].

Metronidazole is really a commonly utilized antibiotic broker. Metronidazole is definitely an antibiotic which successful towards anaerobic germs and particular parasites. Anaerobic bacteria could cause disease within the liver (liver abscess), abdomen (bacterial peritonitis) and pelvis (abscess from the ovaries and also the Fallopian tubes). *Giardia lamblia* as well as ameba tend to be intestinal parasites that may cause stomach pain as well as diarrhea within infected people. Metronidazole selectively blocks a few of the functions inside the bacterial cells and also the parasites leading to their passing away^[10].

It can be used for numerous conditions for example protozoal actions (for instance, giardiasis) anaerobic transmissions, *Helicobacter* connected gastritis, as well as hepato-encephalopathy. Based on Previous reviews metronidazole toxicity might induce a number of neurologic unwanted effects, including ataxic stride, peripheral neuropathy, dysarthria, encephalopathy as well as seizures^[11].

Mechanism of Action

Metronidazole, a nitroimidazole, exerts antibacterial effects in an anaerobic environment against most obligate anaerobes. Once metronidazole enters the organism by passive diffusion and activated in the cytoplasm of susceptible anaerobic bacteria, it is reduced. This process includes intracellular electron transport proteins such as ferredoxin, transfer of an electron to the nitro group of the metronidazole and formation of a short-lived nitroso free radical. Because of this alteration of the metronidazole molecule, a concentration gradient is created and maintained which promotes the drug's intracellular transport^[12,13]. The reduced form of metronidazole and free radicals can interact with DNA leading to inhibition of DNA synthesis and DNA degradation leading to death of the bacteria. The precise mechanism of action of metronidazole is unclear^[14].

Contraindications:

Metronidazole is contraindicated in patients with documented hypersensitivity to the drug or its components, and it should be avoided in first-trimester pregnancy. Patients should also avoid consuming alcohol or products containing propylene glycol while taking metronidazole and within three days of therapy completion. Metronidazole is likewise contraindicated if there has been recent disulfiram use within the past two weeks^[15].

Evaluation of Metronidazole Tablets

Metronidazole tablets were procured from local shop of different Pharmaceutical companies such as **Abbott Healthcare Pvt. Ltd, JB Chemicals and Pharmaceutics, Danish Healthcare Pvt.Ltd.** Evaluation studies were conducted such as thickness, diameter, weight variation test, % friability test, hardness test, disintegration time, dissolution profile and potency.

1. Weight variation test
2. Thickness test
3. Disintegration test
4. % Friability test
5. Hardness test
6. Dissolution test
7. Assay Test

1. Weight variation test

The actual weight variance test is really a satisfactory approach to determining the actual medicine content material uniformity associated with tablets as well as does serve like a pointer in order to good product ion practices (GMP) maintained through the manufacturers along with the amount associated with active pharmaceutical drug ingredient (API) included in the formulation. Ten tablets from every brand items were considered individually inside a weighing stability^[16]. The typical weights from the tablet, in addition to their % deviation, had been calculated (Table 1) utilizing following formula
 Weight variation = $(Iw - Aw) / Aw \times 100\%$

where, Iw = Individual weight of the tablet and Aw= Average weight of the tablet.

Average weight of tablet(mg)	% Deviation
130 or less	10
From 130 to 324	7.5
>324	5

2. Thickness test

Thickness of tablet were measured with the help of Vernier caliper^[17].

3. Hardness Test

Hardness test of metronidazole tablets was found to become with the stated recommendations as provided in BP/USP. Hardness test was performed with the help of Monsanto Hardness tester^[16,18].

4. % Friability Test

This test is supposed to look for the friability associated with uncoated tablets, the phenomenon whereby tablet areas are broken and/or show proof of lamination or even breakage when put through mechanical surprise or attrition. (BP 2000). Friability associated with tablets was no less than 1%. It is therefore not compliance using the BP/USP regular^[16,18].

$$\% \text{ Friability test} = (W_i - W_f) / W_i \times 100\%$$

Where W_i = Initial weight of 20 tablets

Wf = Final weight of 20 tablets

5. Disintegration Test

Disintegration test measures the time required under a given set of conditions for a group of tablets to disintegrate into a particles. For compressed uncoated tablets the testing fluid is water at 37°C, but in some cases the monographs direct that simulated Gastric fluid be used. The BP specification is that uncoated tablets should disintegrate within 15 minutes and film coated in 30 minutes while USP specifies that uncoated and film coated tablets should disintegrate within 30 minutes^[16,18].

6. Dissolution Test

Dissolution test of tablets was performed by using basket method. About 900 ml of 0.1N HCl was filled into 1000 ml basket of dissolution apparatus. One metronidazole tablet was placed into each basket. The dissolution medium washed

up to (37±0.5)°C by an auto heater and 100 rpm was adjusted. 5ml solution was withdrawn from beaker at 10 minutes interval which was replaced with 5ml distilled water and then withdrawn solution was filtered through filter paper^[16,18].

7. Assay Test

Weighed and finely powdered 20 metronidazole tablets. Weighed accurately a portion of a powder equivalent to about 150mg of metronidazole and transferred to a coarse-frits sintered glass funnel. Extracted with four 10ml portions of hot acetone, mixed the solid material well with each portion, and then drained with gentle suction. To the combined acetone extracts added 40ml of acetic anhydride and two drops of malachite green indicator and titrated with 0.1N Perchloric acid in acetic acid to a yellow green end point^[19].

Each millilitre of 0.1N Perchloric acid was equivalent to 17.12mg of C₆H₉N₃O₃.

II. RESULT AND DISCUSSION

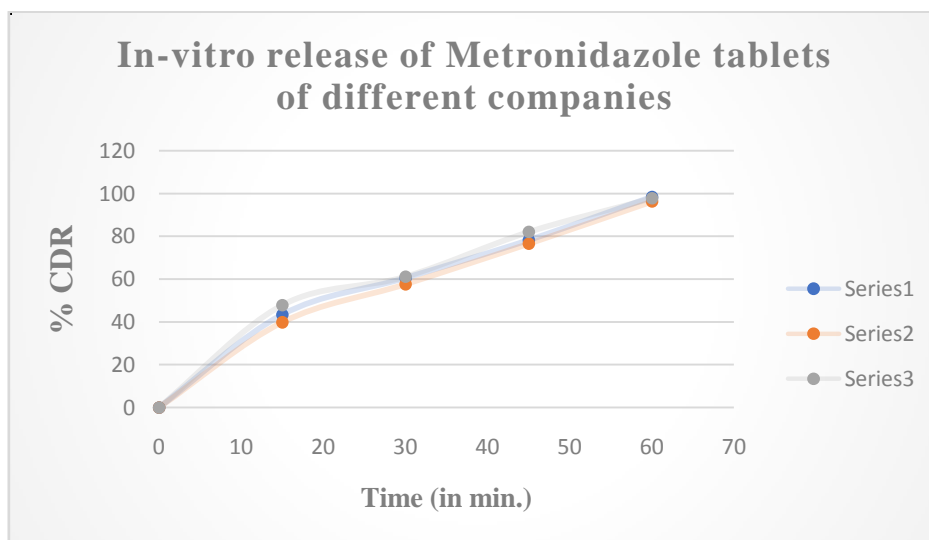
S. No.	Company's Name	Colour	Shape
1	Abbot Healthcare Pvt. Ltd	Yellow	Round
2	Danish Healthcare Pvt.Ltd.	White	Round
3	JB Chemicals and Pharmaceutics	White	Round

S. No.	Company's Name	Weight Variation Test	Thickness in mm (mean ± S.D.)
1	Abbot Healthcare Pvt. Ltd	Pass	1.28±0.0070
2	Danish Healthcare Pvt.Ltd.	Pass	1.27±0
3	JB Chemicals and Pharmaceutics	Pass	1.27±0.0070

S. No.	Company's Name	Hardness in Kg/cm ² (mean ± S.D.)	Friability in % (mean ± S.D.)
1	Abbott Healthcare Pvt. Ltd	4.8±0.0070	0.74 ± 0.0141
2	Danish Healthcare Pvt.Ltd.	4.7±0.1414	0.66 ± 0.0070
3	JB Chemicals and Pharmaceutics	4.8±0.0707	0.63 ± 0.0141

S. No.	Company's Name	Assay in % (mean ± S.D.)	Disintegration in min. (mean ± S.D.)

1	Abbot Healthcare Pvt. Ltd	99.2 ± 0.4949	13.36 ± 0.1838
2	Danish Healthcare Pvt.Ltd.	98.1 ± 0.2121	12.18 ± 0.5091
3	JB Chemicals and Pharmaceutics	97.2 ± 0.9192	11.20 ± 0.3535



Comparative study was carried out for metronidazole tablets obtained from three different Pharmaceutical companies such as Abbott Healthcare Pvt. Ltd., Danish Healthcare Pvt. Ltd. and JB Chemicals and Pharmaceutics. Results were found satisfactory as the metronidazole tablets of different companies was within the Pharmacopoeia limit.

Tests were performed as per the method described in Indian Pharmacopoeia (USP). All brands were found to comply with the USP specifications.

III. CONCLUSION:

The study on Metronidazole tablets was performed in our lab. The tablets obtained from Abbott Healthcare Pvt. Ltd found to be better than Danish Healthcare Pvt.Ltd. and JB Chemicals and Pharmaceutics.

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