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Comparative study of different marketed brands of metronidazole tablets available in Bangladesh

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Abstract
This study is a constructive evaluation of the quality of different Metronidazole brands available in the Bangladesh market. The objective is to determine whether the samples meet the manufacturer's specifications. To achieve this, six different brands of Metronidazole were randomly selected, and their physical and chemical properties were evaluated through various tests, such as weight variation, hardness, friability, thickness, disintegration, dissolution, and *in vitro* assay dissolution. The study also examined the relationship between hardness and dissolution to determine the drug's bioavailability. The results of the study indicate that all the samples met the USP requirements, passing the weight variation, friability, dissolution, and disintegration tests. This study provides crucial and constructive information about the quality of different Metronidazole brands available in the Bangladesh market, which can be used by manufacturers to improve their products and by consumers to make informed decisions about their medication.

Keywords: Metronidazole, quality, USP, dissolution, disintegration

1. Introduction

1.1 Drug Profile

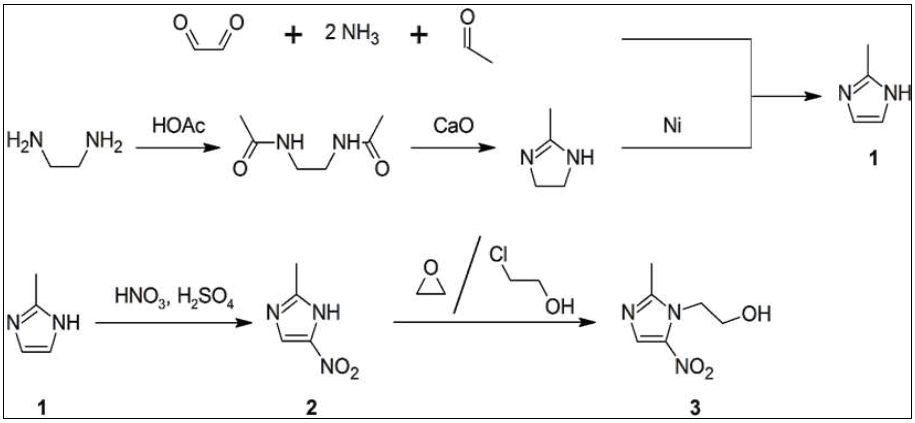
In 1959, Metronidazole was introduced to the market as an effective therapy for Trichomonas vaginalis, and since then, it has been extensively used for the treatment of parasitic infections. This nitroimidazole derivative was found to be effective against anaerobic bacteria in 1962 by Shinn and in 1964 by Davies and associates, who reported its successful treatment of patients with Vincent's angina (Necrotizing ulcerative gingivitis). Numerous articles have substantiated Metronidazole's excellent activity against anaerobes [4]. It is a synthetic nitroimidazole derivative that exhibits both antiprotozoal and antibacterial activities. Un-ionized Metronidazole is rapidly taken up by obligate anaerobic organisms and then reduced by low-redox potential electron-transport proteins to generate an active intermediate product. The reduced form of Metronidazole causes DNA strand breaks that inhibit DNA synthesis and bacterial cell growth [2].
Metronidazole is available in various forms such as tablets, capsules, suspensions, IV infusions, and topical gels [1].

1.2 Synthesis of Metronidazole

Metronidazole is an antibiotic medication that is used to treat various bacterial infections. This medication can be synthesized using a multi-step process, as detailed by [1] and [3]. To begin the synthesis process, 2-methylimidazole is prepared using either the Debus-Radziszewski imidazole synthesis method or by reacting ethylenediamine and acetic acid, followed by treatment with lime. This intermediate compound is then nitrated to produce 2-methyl-4(5)-nitroimidazole, which is subsequently alkylated with either ethylene oxide or 2-chloroethanol. This final step in the synthesis process results in the creation of metronidazole. The multi-step process for synthesizing metronidazole is crucial for ensuring the purity and potency of this medication, which plays an important role in treating bacterial infections.

1.3 Mechanism of Action

Metronidazole belongs to the nitroimidazole class of drugs. Its mechanism of action involves inhibition of nucleic acid synthesis by disrupting the DNA of microbial cells. However, this effect only occurs when metronidazole is partially reduced, which usually occurs only in anaerobic cells. As a result, it does not have any significant effects on human cells or aerobic bacteria [5].



2. Materials and Method

2.1 Chemicals and Reagents

We used only analytical grade chemicals and reagents for our studies, to ensure the accuracy of our results. To obtain a reliable standard Metronidazole sample (assay 99%), we procured it from the laboratory of Stamford University Bangladesh.

To collect the samples, we purchased six distinct brands of Metronidazole tablets from various drug stores, taking care to check the manufacturer name, physical appearance, batch number, date of manufacturing, and expiry date of each sample. Each Metronidazole tablet was labeled with 400 mg of active ingredients. We believe that the systematic approach we took in collecting the samples will help in ensuring the reliability of our results.

2.2 Equipment List

Table 1: The equipment those are used in this project is given below

Name	Model	Origin
Electric balance	DENVER Instrument Model-M 310	Switzerland
KBR Press	-	India
Manual Hardness Tester	Monsanto Type Model-MHT 20	India
Tapped Density Tester	Pharma Test Model-TD 200	Germany
Vernier Caliper	Tricle Brand	Shanghai, China
Single Drum Friability Tester	Pharma Test Model-F10E/ER	Germnay
pH Meter	LIDA Instrument Model-PHS 25	Shanghai, China
Disintegration Tester	Pharma Test	Germany
Dissolution Tester	Pharma Test Model-DT 70	Germany
UV-Visible Spectrophotometer	HACH Spectrophotometer Model-DR/4000u	U.S.A
Single Die Punch	-	India

2.3 Methods for various physical parameter tests

2.3.1 Diameter

The diameter was calculated by using digital vernier calipers. The shape was determined by comparing the shape of the tablet with FDA approval standards for tablet shape. (USP, 2013).

2.3.2 Thickness

The thickness was calculated by using digital vernier calipers. Tablet thickness should be controlled within±5%. (USP, 2013).

2.3.3 Weight Variation

When making tablets with a specific amount of drug and formula, it is important to measure the weight of each tablet to ensure that they contain the right amount of drug. To do this, the weights of 10 tablets are measured and the average weight is calculated. Weight variation is then calculated using the following formula.

$$\text{Weight variation} = \frac{(\text{Weight of tablet} - \text{Averageweight})}{\text{Averageweight of tablets}} \text{X100}$$

Weight variation should not be more than 7.5%. The tablets meet the USP test if no more than 2 tablets are outside the percentage limit and if no tablet differs by more than 2 times the percentage limit. According to the USP, the limit of the weight variation test was, the average weight of 130 mg or less the percentage difference should be±10, more than 130 percentage differences should be±7.5 and 324 mg, and the above percentage difference should be±5. Regarding the experimental result, the average weight of all brands was more than 324 mg along the percentage of differences complied with the limit of±5.

2.3.4 Hardness

Tablet hardness refers to the ability of a tablet to resist pressure or crushing. To measure it, a tablet is placed between two anvils, and force is applied until it breaks. Different devices can be used to measure hardness, including Monsanto, Strong-Cobb, Pfizer, Erweka, and Schleuniger testers. For this particular case, the Monsanto hardness tester was used. It consists of a barrel with a compressible spring between two plungers. The lower plunger is placed in contact with the tablet and a zero reading is taken. The upper plunger is then forced against a spring by turning a threaded bolt until the tablet fractures. The force of fracture is recorded, and the zero force reading is deduced from it. The desired hardness for the tablets was between 2-4 Kg/square cm.

2.3.5 Friability: To test the strength of tablets, a plastic

chamber is used that rotates at 25 revolutions per minute. The tablets are dropped a distance of 6 inches with each revolution, simulating the combined effects of abrasion and shock. A tablet is weighed and placed in the friability tester, which is then operated for 100 revolutions. The tablets are then dusted and weighed again. If the weight loss is less than 0.5 to 1%, the tablets are considered acceptable. However, if capping is observed during the test, the tablet should not be used for commercial purposes, no matter how much weight loss has occurred. Friability is calculated using a specific equation, and it should be less than 1%.

% Friability = (W1-W2)/W1 x 100

W1=Initial weight of the tablet before test.
W2 = Weight of the tablet after test.

The loss of weight is determined in following way:

Loss of weight = Initial weight - Final weight

This loss of weight indicates the friability of the Metronidazole tablet. Finally, the percent of the weight loss was calculated in following way:

$$\%\ \text{ofWeightloss} = \frac{(\text{Initialweight} - \text{Finalweight})\ X100}{\text{Finalweight}}$$

(USP, 2013)

2.3.6 Friability Test
The friability values for Metronidazole brands were ranged from 0 to 0.96%. For all brands, the percent (%) friability was less than 1% which ensures that all the tablets of each brand were mechanically stable.

2.3.7 Disintegration Test
A 1000 ml beaker was filled with around 900 ml of 0.1 NHCL solution. The beaker was then placed into a device and a basket rack containing one Metronidazole tablet in each tube was accurately positioned into the beaker. A plastic disk was placed over each tablet before the basket rack was put in place. The temperature was maintained at 37 °C, which is equivalent to body temperature. The disintegration time was determined as the time at which all the Metronidazole Sodium tablets passed through the sieve. The average disintegration time was then calculated. (USP, 2013) The disintegration time was determined by using a USP tablet disintegration apparatus. Disintegration of the tablet was observed first in 0.1N HCL at 37 ^{o}C for 1 hour.

2.3.8 Procedure for the preparation of standard sample curve of Metronidazole
To prepare a solution, 1 ml, 2 ml, 3 ml, 4 ml, 5 ml, up to 10 ml of the mother solution was taken and added to a volumetric flask. The flask was then filled up to 100 ml using 0.1 N HCl. The absorbance of each solution was measured at 278 nm using a UV spectrophotometer. The absorbance value was then plotted on the Y-axis and the concentration (µg/ml) of the solution was plotted on the X-axis to obtain a linear standard sample curve.

2.3.9 Dissolution test
Conditions
Apparatus: USP 2 (Paddle)
Medium: 0.1 N HCl
Volume: 900 ml
Speed: 100 rpm
Time: 60 min

2.3.10 Procedure
1. The flask is filled with 900 ml of 0.1 N HCl.
2. An autoheater is used to heat the dissolution medium to 37±0.5 °C.
3. Six tablets are placed in six baskets and stirred immediately at 100 r.p.m.
4. After 60 minutes, 10 ml of the sample is withdrawn from the flask.

The dissolved metronidazole is determined by measuring the UV absorbance at a wavelength of approximately 278 nm of the filtered portion of the solution under test. The sample is suitably diluted with 0.1 N HCl and compared with a standard metronidazole solution having a known concentration of USP metronidazole RS in the same medium.

2.3.11 Dissolution test of Metronidazole tablet
For the testing of the solution type II apparatus, a temperature of 37±0.5°C was maintained with a rotation speed of 100 rpm/min. Each vessel contained 900 ml of dissolution medium. The tablets were put into a 0.1 N HCL solution.
To identify individual tablet results, every sub-sample of six tablets was tested simultaneously with a particular vessel and position. At every one-hour interval, a sample of 10 ml was taken from the vessel, and immediately replaced with an equal volume of dissolution medium.
The withdrawn samples were then filtered and diluted and analyzed at 278 nm for Metronidazole by UV spectrophotometer. The amounts of drug present in the samples were calculated from the calibration curve of standard Metronidazole.

2.3.12 Calculation
% of label amount metronidazole dissolved 1 hour

$$= \frac{AT}{AS} \times \frac{WS}{100} \times \frac{1}{100} \times \frac{900}{L} \times \frac{100}{1} \times \frac{P}{100} \times 100 = D$$

Where,
AT = Absorbance of metronidazole in the sample preparation after 1 hour.
AS = Absorbance of metrinidazole in the standard preparation.
WS = Weight of the metronidazole standard in mg.
P = Potency of metronidazole standard in % as is basis.
L = Label claim of the tablet in mg
D = % of label amount metronidazole dissolved in 1 hour

2.3.13 Assay
2.3.13.1 Instrument
UV- Visible Spectrophotometer

2.3.14 Standard Solution
About 400 mg of standard Metronidazole Sodium was accurately weighed and transferred into a 100 ml volumetric flask. Then dissolved and diluted to volume with 0.1 N HCl up to 100 ml.

2.3.15 Test Solution
To prepare each formulation, 400 mg of powder (equivalent to 400 mg of Metronidazole) was accurately weighed and transferred into a 100 ml volumetric flask. Then, 30 ml of 0.1 N HCl solution was added and the mixture was mechanically shaken. The solution was diluted to the mark with 0.1 N HCl solution, mixed thoroughly, and filtered through a Whatman filter paper.

2.3.16 Calculation: Content of Metronidazole per tablet

$$= \frac{AT \times WS \times 100 \times P \times W}{AS \times 100 \times WS(sample) \times 100}$$

Where,

AT = Absorbance of the Metronidazole in the sample preparation.
AS = Absorbance of the Metronidazole in the standard Solution.
WS = Weight of the Working standard sample in mg.
WT = Weight of the test sample in mg.
P = Potency of standard expressed in % on as is basis.
W = Average weight of 10 tablets in mg. (USP, 2013)

3. Results and Discussion

3.1 Physical Parameter

Table 2: Physical appearance of different brands

SL. No	Brand Name	Color	Shape and others
1	Metco 400 mg	White	Oval, uncoated
2	Metryl 400 mg	Yellow	Round, coated
3	Metro 400 mg	White	Oval, coated
4	Filmet 400 mg	Yellowish	Round, coated
5	Flagyl 400 mg	White	Round, coated
6	Amotrex 400 mg	White	Round, coated

Table 3: Label information about the sample

SL. No	Brand Name	Batch No.	Mfg. Date	Exp. Date	Mfg. Lic. No	DAR No	Manufactured by
1.	Metco 400 mg	36	01-01-2019	31-06-2021	385 & 130	188-25-56	Eskayef Bangladesh Ltd.
2.	Metryl 400 mg	255	30-05-2019	01-05-2021	12&80	025-026-027	Opsonin Pharmaceuticals Ltd.
3.	Metro 400 mg	101	10-05-2019	30-05-2021	183&424	242-23-023	Ziska Pharma Ltd.
4.	Filmet 400 mg	64	01-07-2019	30-07-2021	379 & 119	186-44-027	Beximco Pharmaceutical Ltd.
5	Flagyl 400 mg	25	01-07-2019	30-07-2021	39&176	003-262-27	Sanofi Bangladesh Ltd
6	Amotrex 400 mg	14	30-06-2019	01-06-2021	51& 213	005-112-56	ACI Pharmaceuticals

Table 4: Weight Measurement, Thickness, Diameter & Hardness Test For Metco 400 mg

No	Weight (mg)	Thickness (mm)	Diameter (mm)	Hardness (kg)
1	0.676	5.19	14.55	17.44
2	0.665	5.16	14.57	18.71
3	0.663	5.10	14.58	18.29
4	0.667	5.10	14.54	18.49
5	0.662	5.21	14.54	17.96
6	0.667	5.15	14.58	19.39
7	0.672	5.17	14.55	18.15
8	0.671	5.12	14.54	16.62
9	0.673	5.22	14.53	18.98
10	0.677	5.15	14.59	18.32
Average	0.669	5.15	14.55	18.24

Table 5: For Metryl 400 mg

No	Weight (mg)	Thickness (mm)	Hardness (kg)	Diameter (mm)
1	0.695	5.85	19.54	18.14
2	0.685	5.88	17.77	18.14
3	0.695	5.80	18.98	18.16
4	0.690	5.80	19.93	18.14
5	0.691	5.75	18.93	18.15
6	0.691	5.82	19.23	18.18
7	0.698	5.85	17.87	18.17
8	0.693	5.85	18.21	18.15
9	0.700	5.76	19.22	18.12
10	0.691	5.75	19.67	18.15
Average	0.692	5.81	18.94	18.15

Table 6: For Metro 400 mg

No	Weight (mg)	Thickness (mm)	Hardness (kg)	Diameter (mm)
1	0.735	5.19	17.44	14.55
2	0.755	5.16	18.71	14.57
3	0.748	5.10	18.29	14.58
4	0.728	5.10	18.49	14.54

5	0.729	5.21	17.96	14.51
6	0.722	5.15	19.39	14.58
7	0.743	5.17	18.15	14.55
8	0.761	5.12	16.62	14.54
9	0.737	5.22	18.98	14.53
10	0.721	5.15	18.32	14.59
Average	0.7379	5.21	18.24	14.56

Table 7: For Filmet 400 mg

No	Weight (mg)	Thickness (mm)	Diameter (mm)	Hardness (kg)
1	0.546	5.00	12.50	17.88
2	0.522	5.23	12.49	15.91
3	0.531	5.18	12.50	16.89
4	0.543	5.02	12.48	17.70
5	0.547	5.46	12.51	16.14
6	0.542	5.25	12.50	14.12
7	0.538	5.24	12.47	17.23
8	0.529	5.20	12.46	18.61
9	0.534	5.18	12.48	16.80
10	0.531	5.02	12.99	17.21
Average	0.536	4.05	12.53	16.84

Table 8: For Flagyl 400 mg

No	Weight (mg)	Thickness (mm)	Diameter (mm)	Hardness (kg)
1	0.623	5.40	15.01	11.80
2	0.620	5.43	14.89	11.77
3	0.612	5.13	14.76	11.67
4	0.615	5.42	14.83	11.9
5	0.619	5.10	14.83	13.03
6	0.616	5.17	14.60	12.96
7	0.615	5.23	14.85	11.8
8	0.613	5.23	14.78	12.13
9	0.612	5.17	14.75	15.96
10	0.615	5.25	14.75	12.54
Average	0.616	5.25	14.81	12.56

Table 9: For Amotrex 400 mg

No	Weight (mg)	Thickness (mm)	Diameter (mm)	Hardness (kg)
1	0.713	4.59	16.50	19.79
2	0.711	4.41	16.40	19.82
3	0.719	4.42	16.32	19.44
4	0.720	4.54	16.39	19.25
5	0.723	4.47	16.53	19.58
6	0.711	4.37	16.36	19.78
7	0.716	4.44	16.54	19.64
8	0.729	4.44	16.47	19.04
9	0.711	4.41	16.53	19.77
10	0.729	4.48	16.60	19.48
Average	0.718	4.46	16.47	19.56

Table 10: Weight Variation Test

S. No	Brands	Average wt.	Weight variation limit
1.	Metco 400 mg	0.669	-1.04 to +1.19
2.	Metryl 400 mg	0.692	-1.01 to +1.15
3.	Metro400 mg	0.734	-2.29 to +3.13
4.	Filmet 400 mg	0.536	-2.61 to +2.05
5.	Flagyl 400 mg	0.616	-0.649 to +1.13
6.	Amotrex 400mg	0.718	-0.97 to +1.53

Table 11: Average % of friability of different brands

Sl. No	Brands	Average % of friability
1.	Metco 400 mg	0.02%
2.	Metryl 400 mg	0.002%
3.	Metro 400 mg	0.021%
4.	Filmet 500 mg	0.003%
5.	Flagyl 400mg	0.0024%
6.	Amotrex 400 mg	0.001%

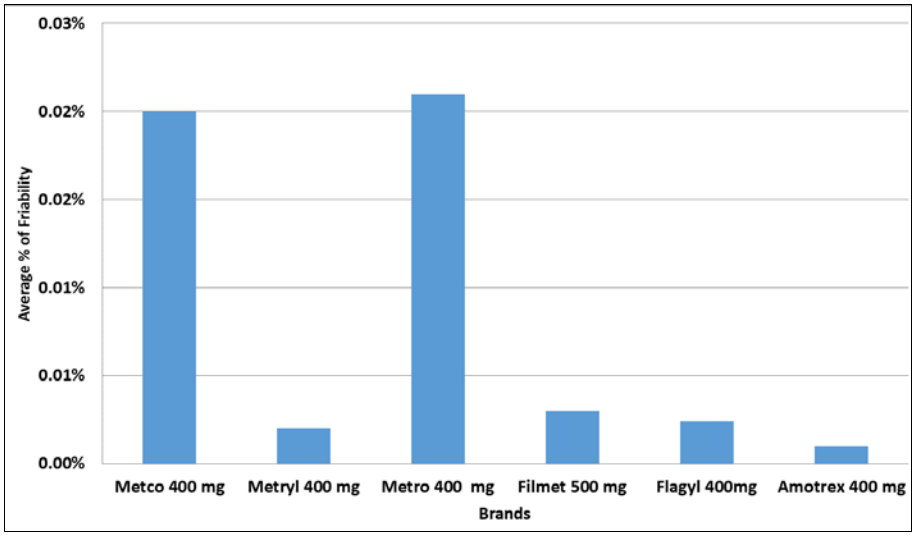


Fig 2: Average % of Friability

3.2 Analytical Parameter
3.2.1 Disintegration Test

Table 12: Disintegration results of six brands

Media	Flagyl 400 mg	Filmet 400 mg	Metro 400 mg	Metry l400 mg	Amotrex 400 mg	Metco 400 mg
0.1 N HCL	11 min16sec	15 min 20 sec	4 min 6 sec	6 min 33 sec	17 min 25 sec	37 sec
	11 min 5 sec	15 min21min	4 min 10 sec	6 min 21 sec	17 min 33 sec	21 sec
	11 min13sec	15 min28min	4 min 12 sec	6 min 34 sec	16 min 48 sec	33 sec
	11 min20sec	15 min28min	4 min 13 sec	6 min 42 sec	16 min 14 sec	49 sec
	11 min 8 sec	15 min32min	4 min 24 sec	7 min 31 sec	17 min 46 sec	1 min 5 sec
	11 min14sec	15 min49min	4 min 31 sec	7 min 42 sec	18 min 13 sec	1 min 2 sec

3.3 Standard calibration curve of Metronidazole (API)

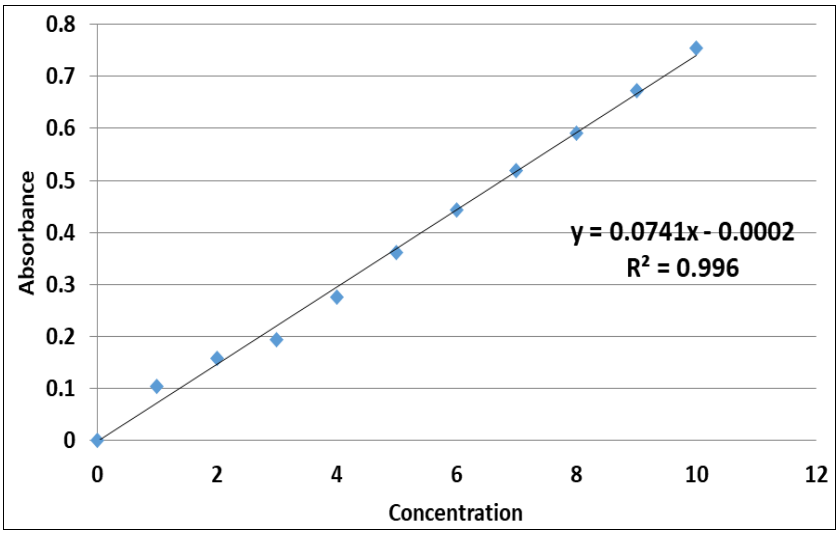


Fig 3: Standard calibration curve of Metronidazole

3.4 Dissolution test of Metronidazole tablet
Calculation

% of label amount metronidazole dissolved 1 hour

$$= \frac{AT}{AS} \times \frac{WS}{100} \times \frac{1}{100} \times \frac{900}{L} \times \frac{100}{1} \times \frac{P}{100} \times 100 = D$$

Where,

AT = Absorbance of metronidazole in the sample preparation after 1 hour.

AS = Absorbance of metrinidazole in the standard preparation.

WS = Weight of the metronidazole standard in mg.

P = Potency of metronidazole standard in % as is basis.

L= Label claim of the tablet in mg

D= % of label amount metronidazole dissolved in 1 hour

Here,

AS = 0.754

WS = 400 mg

P = 98

L= 400 mg

Table 13: Dissolution of METRO (400 mg)

No	Absorbance (AT)	Dissolution rate in 400 mg	% Released
1	0.315	368.47	92.12
2	0.326	381	95.25
3	0.336	393	98.25
4	0.314	367.3	91.8
5	0.319	373.2	93.3
6	0.305	356.8	89.2

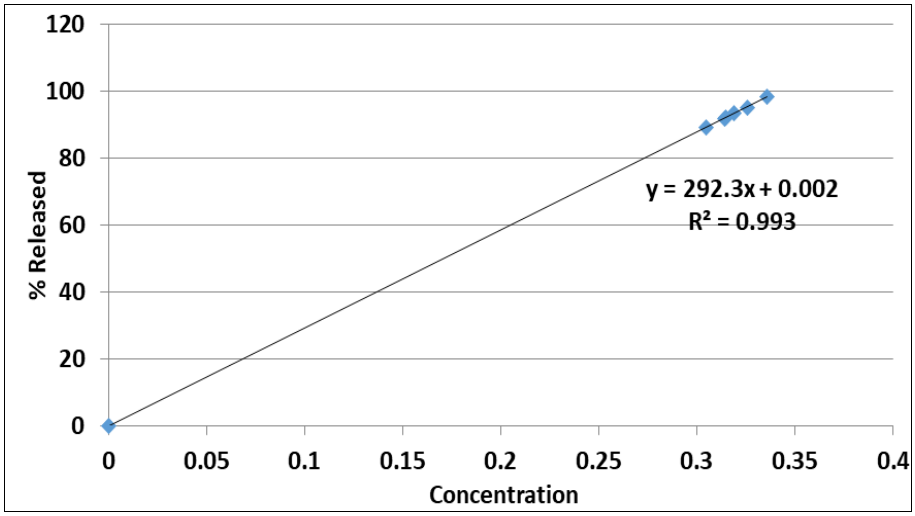


Fig 4: Dissolution of Metro

Table 14: FILMET (400mg) Dissolution of Filmet

No	Absorbance (AT)	Dissolution rate in 400mg	% Released
1	0.325	380.17	95
2	0.319	373.15	93.29
3	0.318	372	93
4	0.335	392	98
5	0.338	395.4	99
6	0.322	376.66	94.2

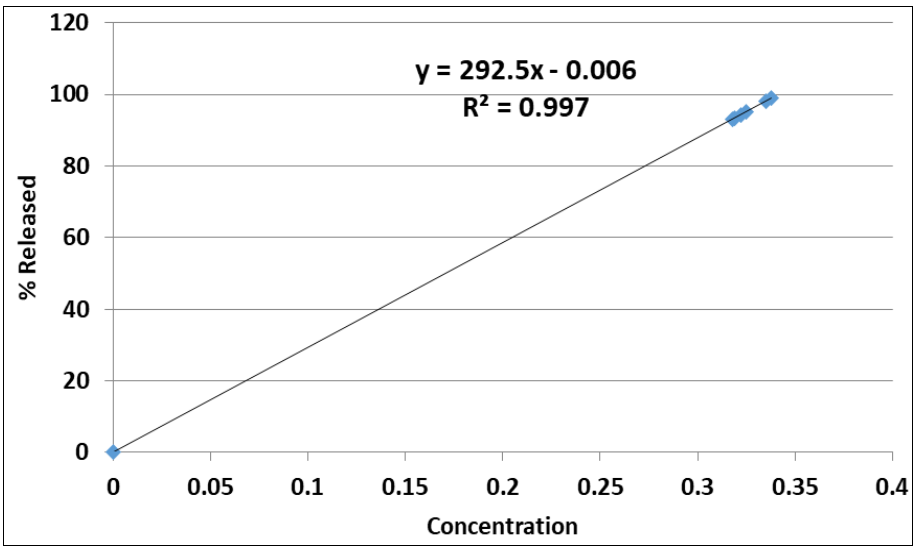


Fig 5: Dissolution of Filmet

Table 15: METRYL (400 mg) Dissolution of Metryl

No	Absorbance (AT)	Dissolution rate in 400mg	% Released
1	0.340	397.7	99.4
2	0.315	368.47	92.12
3	0.336	393	98.25
4	0.346	404.7	101.18
5	0.317	371	92.75
6	0.332	388	97

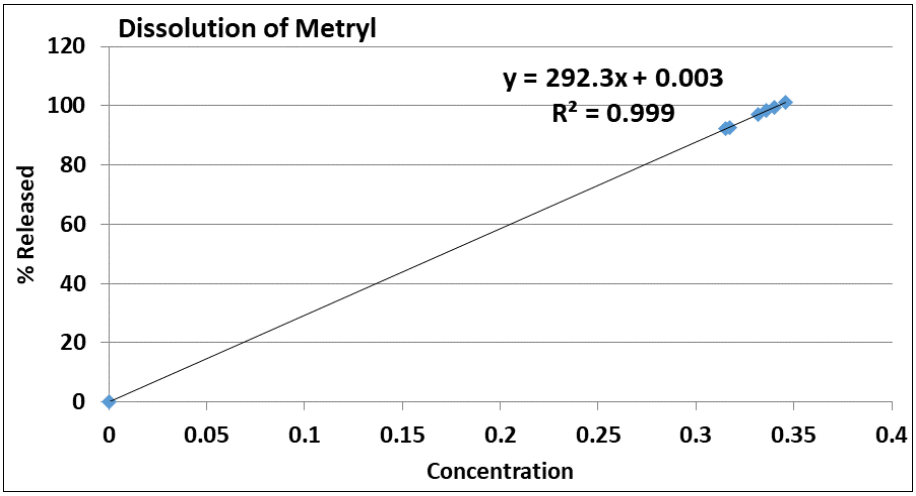


Fig 6: Dissolution curve of Metryl

Table 16: FLAGYL (400 mg) Dissolution of Flagyl

No	Absorbance (AT)	Dissolution rate in 400mg	% Released
1	0.315	368.45	92.11
2	0.316	369.64	92.41
3	0.325	380.17	95.04
4	0.335	392	98
5	0.331	387.2	96.8
6	0.341	399	99.75

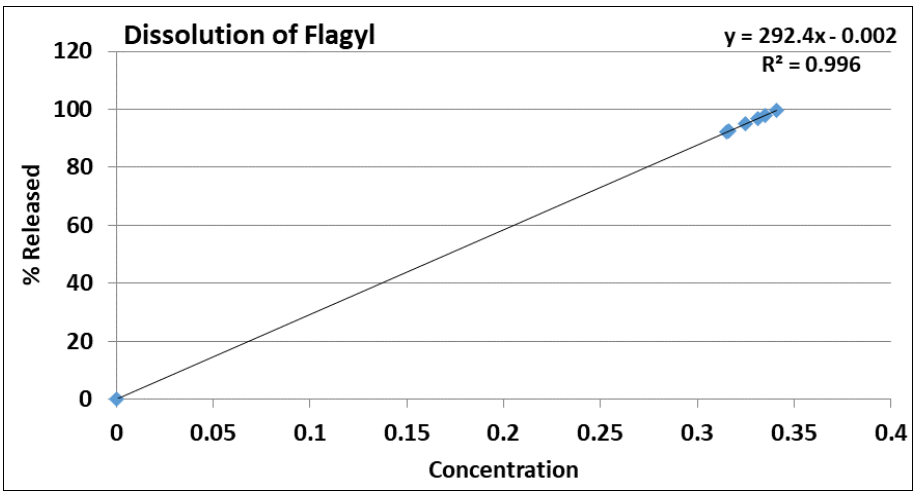


Fig 7 Dissolution curve of Flagyl

3.5 Dissolution of Metco

Table 17: METCO (400 mg)

No	Absorbance (AT)	Dissolution rate in 400mg	% Released
1	0.325	380.17	95.04
2	0.344	402.4	100.6
3	0.335	392	98
4	0.341	399	99.75
5	0.341	399	99.75
6	0.352	411.8	102.95

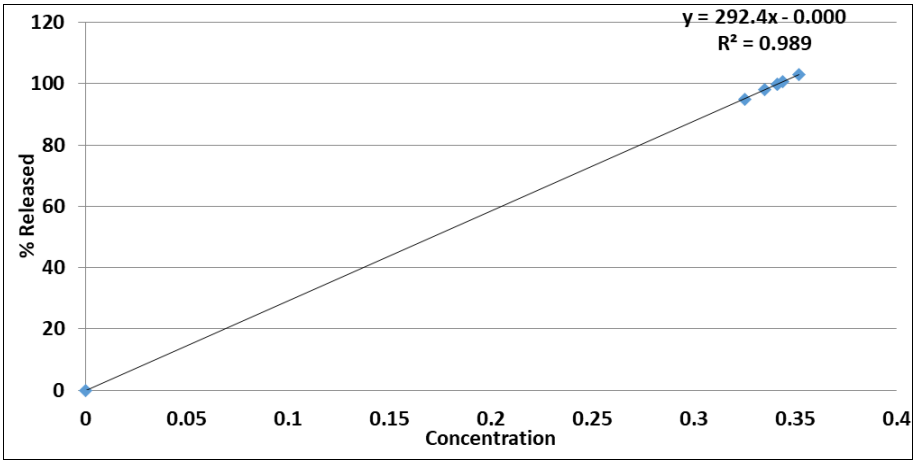


Fig 8: Dissolution of Metco

3.6 Dissolution of Amotrex

Table 18: Amotrex (400 mg)

No	Absorbance (AT)	Dissolution rate in 400mg	% Released
1	.338	395.4	99
2	.333	389.53	97.38
3	.348	407.1	101.78
4	.343	401.23	100.3
5	.337	394.2	98.55
6	.344	402.4	100.6

3.7 Average Dissolution of 6 brands

Table 19: Average of six brands

Brand name	Absorbance (AT)	Dissolution rate in 400mg	% Released
Metro	0.319	373.15	93.29
Filmet	0.326	381.34	95.34
Metryl	0.331	387.2	97
Flagyl	0.327	382.51	96
Metco	0.34	397.7	99.4
Amotrex	0.340	397.7	99.4

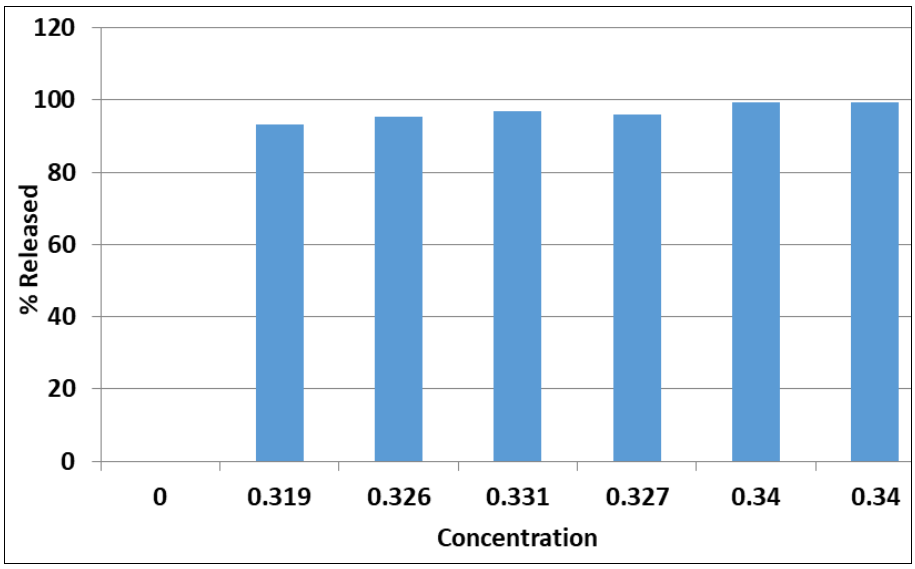


Fig 9: Average Dissolution of Six Brands

3.8 Assay

The purpose of this study was to measure the quality of different brands of paracetamol tablets available in Bangladesh and to determine if they meet the standards set in the official compendiums. As per the USP guidelines, the limit for paracetamol is between 85% and 100%. After our evaluation, we found that all brands of paracetamol available in Bangladesh meet this requirement. Content of

Metronidazole per tablet

$$= \frac{AT \times WS \times 100 \times P \times W}{AS \times 100 \times WS(sample) \times 100}$$

Where,
AT = Absorbance of the Metronidazole in the sample preparation.
AS = Absorbance of the Metronidazole in the standard Solution.
WS= Weight of the Working standard sample in mg.
WT= Weight of the test sample in mg.
P = Potency of standard expressed in % on as is basis.
W = Average weight of 5 tablets in mg.
HERE,
AS= 0.754
WS= 400mg
WT=400mg
P=98
W=0.618 Flagyl, 0.538 Filmet, 0.739 Metro, 0.691 Metryl, 0.666 Metco, Amotrex 0.717

Table 20: Percent of the assay of brand with standard Metronidazole

Brand name	Absorbance (AT)	% of assay with standard
Amotrex 400mg	0.994	93%
Metro 400mg	0.995	96%
Flagyl 400mg	0.997	81%
Metryl 400mg	0.998	90%
Metco 400mg	0.998	87%
Filmet 400mg	0.999	70%

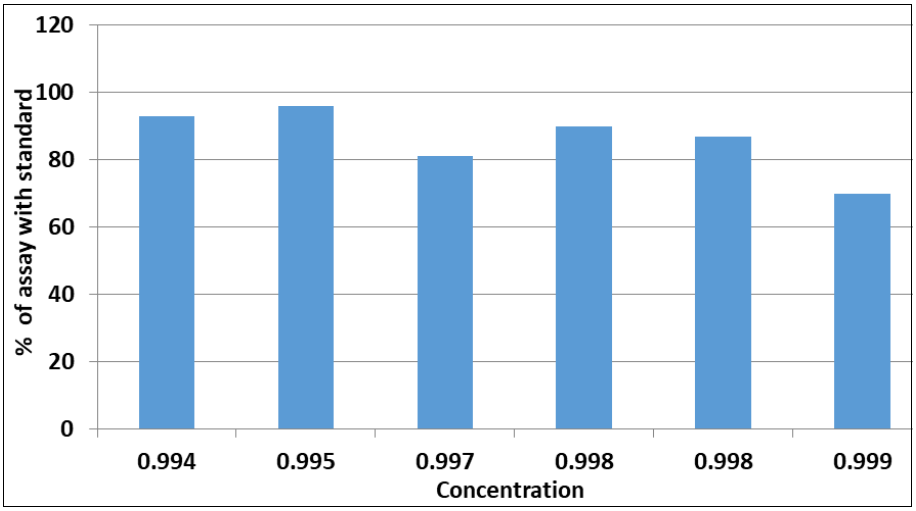


Fig 10: Assay of Six Brands

4. Discussion

4.1 Physical Parameter

During the weight variation test, six different brands of Metronidazole tablets, Filmet 400 mg, Flagyl 400 mg, Metco 400 mg, Metryl 400 mg, Metro 400 mg, and Amotrex 400 mg were evaluated for their weight variation. The results showed that all brands were within the acceptable range, indicating that they are consistent and reliable.

The tablets were also tested for their hardness or crushing strength. The acceptable range for the hardness of a tablet is between 4 to 7 kgf (kilogram of force). Four tablets of each brand were tested, and their hardness measured. The results showed that the average hardness for each brand was between 1 and 2 kg/f. This information is vital as the hardness of a tablet is crucial in determining its ability to withstand the stress of packaging, transportation and handling.

The six brands of Metronidazole tablets were tested using a Monosanto hardness tester, and all passed the limit specified. This test ensures that the tablets are of consistent quality and meet the required standards.

The friability of Filmet 400 mg, Flagyl 400 mg, Metco 400 mg, Metryl 400 mg, Metro 400 mg, and Amotrex 400 mg was also assessed. Friability is a measure of the tablet's ability to withstand abrasion during handling and transportation. The results showed that the friability of each brand was within the acceptable range, with Filmet 400 mg and Amotrex 400 mg having the lowest friability rates of 0.003% and 0.001%, respectively.

Overall, this study provides essential information about the quality of six different brands of Metronidazole tablets, including their weight variation, hardness, and friability. The results show that all brands are of good quality and meet the required standards.

4.2 Analytical Parameter

The absorbance levels of dissolution for six different medications, namely, Filmet 400 mg, Flagyl 400 mg, Metco 400 mg, Metryl 400 mg, Metro 400 mg, and Amotrex 400 mg were determined and measured. The results show that the dissolution absorbance levels of Filmet 400 mg, Flagyl 400 mg, Metco 400 mg, Metryl 400 mg, Metro 400 mg, and Amotrex 400 mg were 0.326, 0.327, 0.34, 0.331, 0.319, and 0.340 respectively. Moreover, the corresponding percentage of dissolution with standard value was 95.34%, 96%, 99.4%, 97%, 93.29%, and 99.4% respectively.

In addition, the absorbance levels of Metronidazole were measured and found to be 0.104, 0.159, 0.195, 0.277, 0.361, 0.443, 0.519, 0.591, 0.673, and 0.754.
Lastly, the percentage of assay for Filmet 400 mg, Flagyl 400 mg, Metco 400 mg, Metryl 400 mg, Metro 400 mg, and Amotrex 400 mg were determined to be 70%, 81%, 96%, 98%, 97%, and 93% respectively.

5. Conclusion

Our preliminary studies have yielded promising results that indicate that the quality of Metronidazole solid dosage forms from six different brands in Bangladesh is being maintained, as they meet the official specifications of *in vitro* dissolution study and assay. It is noteworthy that in most cases, all brands have passed the tests with flying colors, including weight variation, friability, disintegration time, and percentage of the assay.
Given that drug substances are critical to saving lives, pharmaceutical companies must exercise caution during the production and marketing of pharmaceutical products. Our study underscores the importance of pharmaceutical companies' accountability in ensuring drug quality, as they are dealing with human lives. We hope that our findings will encourage more pharmaceutical companies to adhere to quality standards and guidelines. Additionally, our study could be valuable for further research on Metronidazole.

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