Short Communication

Dhaka Univ. J. Sci. 60(2): 289-290, 2012 (July)

Estimation of Iron and Metronidazole Content from Respective Oral Dosage Forms Available in Local Market

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Received on 05. 10. 2011. Accepted for Publication on 01. 12. 2011.

Iron is an absolute requirement for most forms of life, including humans and most bacterial species. In humans, iron is an essential component of proteins involved in oxygen transport. Iron is essential to life, because of its unique ability to serve both as an electron donor and acceptor and for the regulation of cell growth and differentiation. Iron supplements are prescribed by doctors for medical reasons. Supplemental iron is available in two forms: ferrous and ferric[1]. Metronidazole was introduced as an antiprotozoal agent but it is also active against anaerobic bacteria. It is effective in the therapy of pseudo membranous colitis and aclostridial infection. It is the most effective drug available for invasive amoebiasis involving the intestine or the liver. Metronidazole was found to have particularly high activity *in vitro* and *in vivo* against *Tricomonas vaginalis and Enterobacter histolytica*[2].

Various types of oral dosage forms **(**tablets or capsules) of iron and metronidazole[3], manufactured by different pharmaceutical companies, are available in local market. These dosage forms are taken by the people according to the prescription of the doctors. The content of the active ingredients in dosage forms are specified by the manufacturers, but in many cases the declared amounts of the active ingredients are not found to be present within the acceptable range. This is a report of estimation of iron content in different iron tablets or capsules by both titrimetric method and UV-spectrophotometric method, and estimation of metronidazole content in different metronidazole tablets only by UV-spectrophotometric method.

Collection of iron and metronidazole tablets: Iron tablets or capsules and metronidazole tablets of ten and seventeen companies, respectively were collected from local market. The brand names of different iron tablets or capsules, which were used for analysis, were Ferocit, Femitab, Ipec-plus, Hemofol-TR, Zif, Zeefol, Ferrolin-TR, Feofol-CI, Feona_Z and Alneed-plus. The brand names of metronidazole tablets were Remetrol, Metsina, Filmet, Nidazyl, Metro, Dirozyl, Metco, Biozyl, Metryl, Amodis, Amotrex, Flamyd, Klion, Metason, Metronid, U-Met and Albion. The iron tablets/capsules and metronidazole tablets were arbitrarily marked as F_1 to F_{10} and M_1 to M_{17}, respectively for analytical purpose.

Preparation of sample: Ten tablets or capsules of a particular brand were weighed and average weight was recorded. Then tablets or capsules were crushed into powder using mortar and pestle. Amount of average weight which is equivalent of one tablet or capsule of crushed powder was used for analysis.

Estimation of iron content in the iron tablets and capsules by titrimetric method[4]: For the analysis of iron tablets or capsules, powdered sample (average weight) was dissolved in 20 mL dilute sulphuric acid and this solution was diluted into volumetric flask (100 mL). The prepared solution (10.0 mL) was taken in a conical flask with syrupy sulphuric acid and phosphoric acid mixture (15 mL). Estimation of iron content in different tablets was done by titrating with standard potassium dichromate in presence of diphenylamine indicator. The results are presented in Table-1. Each result is the average of six values.

Table. 1. Amount of iron(II) content in iron tablet or capsule estimated by titrimetric method and UV-spectrophotometric method.

Sample code	Active ingredient	Wt. of one dosage form (g)	Theoretical amount of iron (mg)	Amount of iron(II) (mg/tablet)	
				Titrimetric method	UV-Spectrophotometric method
F1	Ferrous fumarate BP[a]	0.3310	65.74	59.27	39.47
F2	Ferrous fumarate BP[a]	0.3464	65.74	61.49	40.47
F3	Iron(III) hydroxide polymaltose complex INN[b]	0.4501	47.0	50.54	42.52
F4	Ferrous sulfate BP[c]	0.4372	55.17	48.77	43.72
F5	Dried ferrous sulfate BP[c]	0.4650	55.17	52.42	40.95
F6	Dried ferrous sulfate USP[c]	0.4347	55.17	49.59	41.12
F7	Dried ferrous sulfate BP[c]	0.4838	55.17	49.29	43.35
F8	Elemental iron (as carbonyl iron)[d]	0.3356	50.0	46.05	33.31
F9	Dried ferrous sulfate[c]	0.4872	55.17	49.85	43.10
F10	Dried ferrous sulfate[c]	0.4567	55.17	52.05	43.47

a: 200 mg; b: 188 mg; c: 150 mg; d: 50 mg.

Estimation of iron content in the iron tablets and capsules by UV-spectrophotometric method[5]: Standard Fe(II) solution of 0.1, 0.2, 0.5, 1.0, 2.0 ppm was prepared by adding hydroxyl ammonium chloride solution (1.0 mL), 1, 10-phenanthroline solution (5.0 mL) and sodium acetate solution (8.0 mL) in a volumetric flask (100 mL) to produce the red color of ferrous 1,10-phenanthroline. Each solution was diluted to exactly 100 mL and a blank solution was prepared for using as a reference. Absorption of each solution including blank was recorded at 510 nm using a UV-visible spectrophotometer (Shimadzu UV-160A). The absorbances of the standard solutions were plotted against concentration to obtain a calibration curve. Accurately weighed powdered iron tablet or capsule (0.2 g) was dissolved in aqua-regia and diluted into 100 mL. This solution was again diluted 10 times by taking 10.0 mL of this solution into another volumetric flask (100 mL). Hydroxyl ammonium chloride (1.0 mL), 1,10-phenanthroline (5.0 mL) and sodium acetate solution (8.0 mL) were added to it. Finally volume was made up to the mark with distilled water. The absorbance of the sample solution was recorded at 510 nm using a UV-visible spectrophotometer. Using the calibration curve, the final concentration of iron (II) in the sample solution was estimated. The results are presented in Table-1. Each result is the average of six values.

Table-2. Amount of metronidazole content in metronidazole tablet estimated by UV-spectrophotometric method.

Sample code	Amount of metronidazole found (mg)	Potency (%)*
M1	410.00	102.25
M2	410.00	102.25
M3	404.00	101.00
M4	415.00	103.75
M5	400.00	100.00
M6	406.00	101.50
M7	401.50	104.25
M8	413.00	103.25
M9	409.00	102.25
M10	400.00	100.00
M11	498.00	99.60
M12	401.00	100.25
M13	409.00	102.25
M14	402.00	100.50
M15	405.00	101.25
M16	398.00	99.00
M17	380.00	95.00

* Declared amount of active ingredient in each tablet was Metronidazole BP 400 mg

Estimation of metronidazole content in metronidazole tablets by UV-spectrophotometric method[3]: A standard metrinidazole solution (0.023 mg/mL, Solution-1) was prepared by adding required amount of standard metronidazole into a volumetric flask (100 mL). HCl solution (0.1M) was added to make to volume upto the mark. Absorbance of this solution was measured at 277 nm using a UV-visible spectrophotometer. This standard solution (Solution-1) was serially diluted to prepare 0.0023, 0.0046, 0.0069, 0.0092, 00115, 0.0138, 0.0161, 0.0184 and 0.0207 mg/mL standard metronidazole solutions. The absorbance of each standard solution was measured at 277 nm using a UV-visible spectrophotometer. A calibration curve was prepared by plotting absorbance of the standard solutions against different concentrations. One powdered tablet (average weight) was dissolved in little amount of HCl (0.1M). The solution was filtered. The volume of the filtrate was adjusted to 100 mL by adding HCl (0.1M) using a 100 mL volumetric flask. This solution was again diluted to 200 times. The absorbance of this sample solution was recorded using a UV-visible spectrophotometer. Using the calibration curve, the final amount of metronidazole in the sample solution was estimated. The results are presented in Table-2. Each result is the average of six values. Theoretically, the amount of iron content in the sample F1 is 65.74 mg. It was found to be 59.27 mg by titrimetric method. On the other hand, the amount of iron content the sample F1 was found to be 39.47 by spectrophotometric method which is less than titrimetric method. Almost similar variation was found in other tablets or capsules. In titrimetric method, the estimated amount of iron(II) in each dosage form was found to be 5 to12% less than that of the theoretical amount. This could be happened due to personal errors or tablet may contain lesser amount of iron content than the value declared by the manufacturers.

In UV-spectrophotometric method, the estimated amount of iron(II) in each dosage form was found to be 15 to 35% less than that of the theoretical amount. For metronidazole tablets, the estimated value varies from 380 mg to 415 mg/tablet which are very close to the declared value (400 mg). For metronidazole tablets in UV-spectroscopic method, the estimated amount of metronidazole in each dosage form was found to be 1 to 5% less than that of the declared amount. However, the variation of the values of active ingredient for both the iron or metronidazole tablets may be due to personal errors, but this finding gives the idea about the potency of the tablets used according to the prescription of the doctors.

Finally it can be concluded that the results obtained by this experimental procedure are less than the value stated by the manufacturer but the variation is within the acceptable range.

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