WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.084
Volume 9, Issue 3, 1651-1658. Research Article ISSN 2277– 7105

FORMULATION AND DEVELOPMENT OF IBUPROFEN TABLET: AN IN VITRO STUDY FOR BIOEQUIVALENCE OF NEW FORMULATION

Sharmin Akter Anny, Md. Mominur Rahman, Fahadul Islam, Abdur Rahman, Sadia Afroz, Sharifa Sultana, Sabrina C. Raka, A. K. Azad and Sharif Mohammad Shaheen*

Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, Dhaka -1207, Bangladesh.

Article Received on
19 Jan. 2020,

Revised on 09 Feb. 2020,
Accepted on 29 Feb. 2020,

DOI: 10.20959/wjpr20203-17003

***Corresponding Author**
Sharif Mohammad Shaheen
Department of Pharmacy, Faculty of Allied Health Sciences, Daffodil International University, Dhaka -1207, Bangladesh.

ABSTRACT

Cost effectiveness is a very important think to formulate a product. People can get good product with a low price they must prefer the product. For developing a drug, bioequivalence test must be needed because of ensuring the therapeutic performance of drugs which have undergone changes in manufacturing processes as well as in formulation-modifications. Here we tried to develop a formulation of Ibuprofen tablets (400mg) in a cost-effective way so that people can use effectively with low price. We also evaluated release profile, similarity factor (f_2) and mechanical properties of Ibuprofen tablets. This formulation shows a significant similarity with standard (Flamex, ACI Limited) where the similarity factor f_2 was 84% after 60 minutes where it is said that the similarity factor between new developed drug and standard should be at least 80% at 60 minutes. So this new formulation might be a better marketed product with at least one third (1/3) less cost because of the low price of excipients with good quality.

KEYWORDS: Ibuprofen, flamex, bioequivalence, similarity factor, release profile.

INTRODUCTION

In spite of the various bottle necks (dysphagia[1], patient in cooperation as in pediatric[2], geriatric & Psychiatric patients) the most preferred mode of administration for many types of medication is oral route, due to its simplicity, convenience and patient acceptability. In recent years, fast dissolving tablets have been developed to facilitate the drug administration through mouth. Fast dissolving tablets are defined as a solid dosage form containing

medicinal substances that disintegrates rapidly, usually within a matter of seconds. The various synonyms for the Fast dissolving tablets (FDT'S) are fast dissolve, quick dissolve, rapid melt, quick disintegrating. The Fast disintegrating property of tablet is attributed to a quick uptake of water into the tablet matrix which creates porous structure and result in rapid disintegration. Some tablets are designed to dissolve in saliva remarkably fast, within a few seconds and are called as oral disintegrating tablets (ODT'S). Ibuprofen is one of the non-steroidal anti- inflammatory drugs (NSAID)[4] which is orally active antipyretic, analgesic used in the treatment of osteoarthritis, acute and chronic pain, rheumatoid arthritis and related condition. It is treated for relief of signs and symptoms and relief of mild to moderate pain and is used in chronic and acute conditions of pain and inflammation. It may also be used to close a patent ductus arteriosus in a premature baby. It can be used by mouth or intravenously. It show action within an hour.[5]

The pharma industry is the most technologically advanced sectors in existence in Bangladesh. It became grown in the last few years at considerable rate. The skills and innovative knowledge of the pharmacist and innovative ideas of the people involved in these fields for the developments.[6] Now a days Bangladesh's pharmaceutical industry is exporting their products to above 100 countries around the world, and this number is expected to increase in day by day. Almost all pharma industry are trying to make their drugs are qualityful, try to improve and maintain standard of GMP. The acquiring ISO Certification. Almost all major pharmaceutical companies already achieved ISO Certification in 2001 or going to achieve soon.[7,8]

MATERIALS AND METHODS

Ibuprofen which is used as API were collected from Daffodil International University which was properly checked by their physical appearance, manufacturer name, batch name, manufacturing and expiring date, manufacturing license number. Excipients were collected from Daffodil International University that was also checked by the author. No excipients were taken and analyzed whom date of expiry had already been passed. The standard of Ibuprofen obtained from Daffodil International University which is 99% pure.

Reagents and Apparatus

Ibuprofen, Avicel, lactose, talc, Mg stearate, 8% starch, sodium starch glycolate, distilled water, phosphate buffer, volumetric flask, beaker, pipette, funnel, filter paper etc.

Method used for tablet formulation

Generally there are three way by which tablet can be formulate:

1. Direct compression
2. Dry granulation
3. Wet granulation

As Ibuprofen is a heat sensitive and moisture sensitive that's why we use direct compression or dry granulation. The active pharmaceutical ingredient (API) and all the excipients were weighed accurately.[9]

Evaluation of powder blend

The prepared powder blend was evaluated for following different parameters.

Bulk density

Bulk density (ρb) indicates the ratio of total mass of powder to the bulk volume of powder. It was determined by pouring the accurately weighed amount (M) of the powder blend into graduated cylinder and the initial volume of packing also called as bulk volume (Vb) was measured.[10]

The bulk density was then calculated by the following formula.

$\rho b = M / Vb$

Tapped density

Tapped density (ρt) indicates the ratio of total mass of the powder to the tapped volume of powder.

It was determined by using method described by Levis et al.[11]

$\rho t = M / Vt$

Carr's compressibility index

Carr's compressibility index is used to indicate the compressibility of a power. It is named after the scientist Ralph J. Carr, Jr.[12]

It was calculated by the formula given below:

$\text{Carr's Index} = [(\rho t - \rho b) / \rho t] \times 100$

In a free-flowing powder, the bulk density and tapped density would be close in value, therefore, the Carr index would be small. On the other hand, in a poor-flowing powder where there are greater interparticle interactions, the difference between the bulk and tapped density observed would be greater, therefore, the Carr index would be larger.

Hausner's ratio

Hausner's ratio (H) indirectly expresses an ease of flow of powder blend.[13]

It was calculated by the formula given below: Hausner's ratio (H) = ρt / ρb

Angle of repose

The angle of repose (θ) is used to measure the friction forces in the powder blend or granules. It indicates the maximum angle which is possible between the surface of the pile of powder blend or granules and the horizontal plane.

The angle of repose can range from 0° to 90°.

It was determined by using method described by Wells, 2002.[14] Angle of repose was calculated by the formula given below:

$\tan \theta = h/r$

$\theta = \tan^{-1} (h/r)$

RESULTS

The oral bioavailability of the drug depends entirely on the rate of drug dissolution. Therefore, it is very important to evaluate the dissolution data and comparison of dissolution profiles different products available in the market. Table 2 and table 3 show the average percentage of drug release after an hour. f_2 test was applied to the release rate and shown in table 4.

Table 1: Weight variation Test result.

Sl. No	Weight (mg)	Avg. Weight(mg)	Weight Variation(%)
1	585	602	-2.823
2	590		-1.993
3	610		1.328
4	630		4.651
5	595		-1.162

Table 2: Dissolution test for new formulated drug.

Time interval	Range of drug release%					Avg.	SD%
	SM-1	SM-2	SM-3	SM-4	SM-5		
15mitutes	30.23	32.01	35.03	31.19	28.53	31.698	2.408
30minutes	42.56	46.65	48.67	47.63	45.75	46.252	2.333
45minutes	67.40	69.02	71.65	70.04	68.60	69.342	1.599
60minutes	84.30	90.07	89.53	80.77	81.67	85.268	4.339

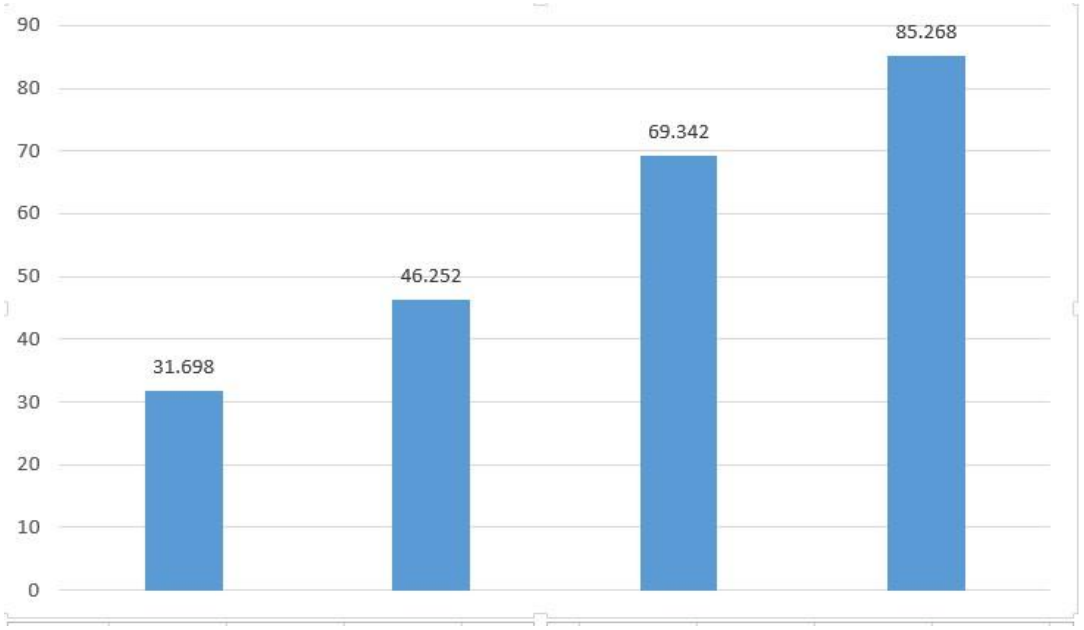

Figure 1: Release Chart Preparation of standard curve of Ibuprofen.

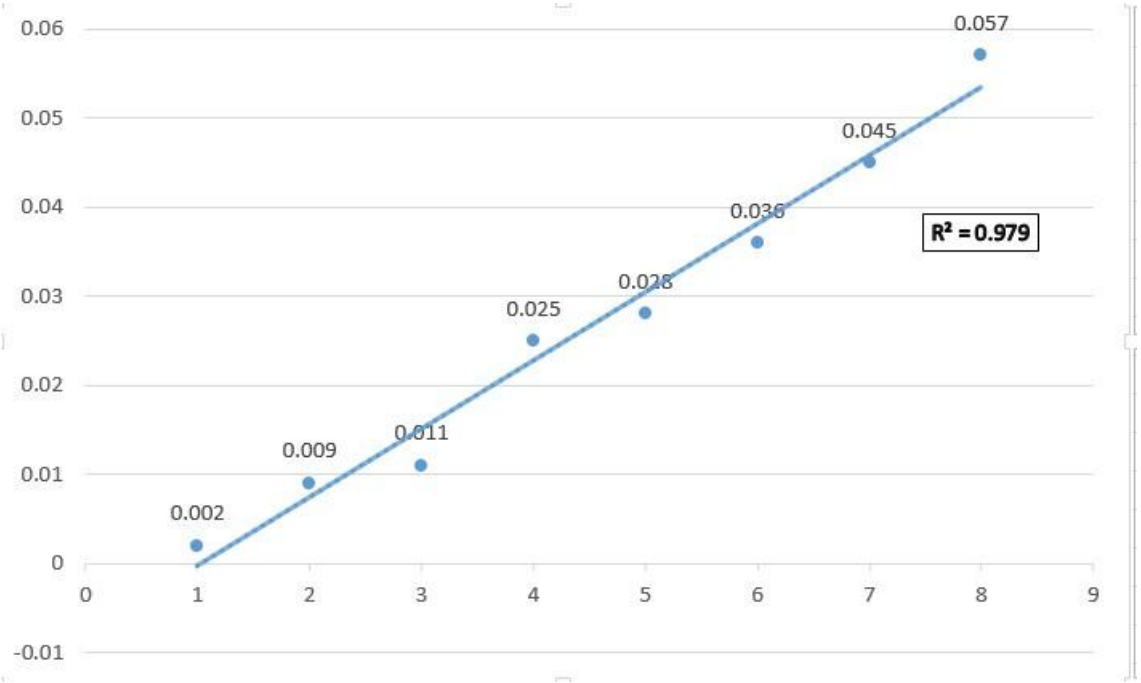

Figure 2: Standard curve of Ibuprofen Comparison of dissolution profile Dissolution test for local Ibuprofen 400mg tablet.

Table 3: Dissolution rate for SM-1 to SM-3.

Time interval	Range of drug release%			Avg.	SD%
	SM-1	SM-2	SM-3		
15minutes	34.23	36.26	42.05	37.51	4.0578
30minutes	72.42	46.65	71.67	63.58	14.667
45minutes	87.56	78.03	88.96	84.85	5.948
60minutes	98.77	99.45	99.89	99.37	0.5642

Table 4: f_2 factors for reference vs. test product.

Time	f_2 factor
15minutes	86.428
30minutes	73.956
45minutes	79.940
60minutes	84.126

DISCUSSIONS

At 60 minutes if the f_2 factor is at least 80% then it would be acceptable. Here the f_2 factor is more than 80% at 60minutes. So it should be told that new formulated drug is acceptable. It should be think that if some precaution can be taken then it should give more effective result. This in vitro test is done by me. I have plan to work in vivo test on it in future.[15]

CONCLUSION

Ibuprofen tablets were successfully developed using moisture activated dry granulation method. It has been manufacturing analyzing to find their correct quality status. For this purpose, the sample of Ibuprofen tablets was analyzed by using established methods and apparatus. All the sample tested, showed a good result for weight variation, dissolution rate. The in-vitro results indicated that the tablets were potentially useful. The moisture activated dry granulation method was found to be simple, reproducible, easily controllable, economical, and continues process. Additionally, the excipients used for the formulation of tablets were cheap and easily available. The present study, although performed on a limited scale yet on the basis of professional judgment the data reported in the study can help the Drug Control Authority to get idea about the quality status of the marketed Ibuprofen preparations in Bangladesh.

We were manufacturing the Ibuprofen tablet and evaluating weight variation, dissolution test according to BP/USP specification. Also compare with a local product to ensure my

formulation is right and followed BP/USP specification and maintain most of the quality of local branded Ibuprofen tablet with a cheap rate.

So I can be concluded that after in vitro bioequivalence test as this formulation had given better result so it should be well developed Ibuprofen drug with a low price that can affordable to all of people with a good effectiveness.

ACKNOWLEDGEMENT

The authors are grateful to the Department of Pharmacy, Daffodil International University, Dhaka, Bangladesh for for all sorts of supports throughout the study.

REFERENCES

1. NHS inform. Available from https://www.nhsinform.scot/illnesses-and-conditions/stomach-liver-and-gastrointestinal-tract/dysphagia-swallowing-problems
2. Nature.com Available from https://www.nature.com/subjects/paediatrics
3. Bhosale Amol V. *Development of Fast Dissolving Tablets of Bisoprolol Fumarate and Statistical Optimization by Using 32 Factorial Design* (Doctoral dissertation, The Erode College of Pharmacy and Research Institute, Erode).
4. Rao P, Knaus EE. Evolution of nonsteroidal anti-inflammatory drugs (NSAIDs): cyclooxygenase (COX) inhibition and beyond. Journal of Pharmacy & Pharmaceutical Sciences, 2008 Sep 20; 11(2): 81-110s.
5. Berde CB, Sethna NF. Analgesics for the treatment of pain in children. New England Journal of Medicine, 2002 Oct 3; 347(14): 1094-103.
6. Habib MA, Alam MZ. Business analysis of pharmaceutical firms in Bangladesh: problems and prospects. Journal of Business and Technology (Dhaka), 2011; 6(1): 61-77.
7. Hoekman BM, Kostecki MM. The political economy of the world trading system: the WTO and beyond. Oxford University Press, 2009.
8. Kabeer N, Mahmud S. Rags, riches and women workers: export-oriented garment manufacturing in Bangladesh. Chains of fortune: Linking women producers and workers with global markets, 2004: 133-64.
9. Fu Y, Yang S, Jeong SH, Kimura S, Park K. Orally fast disintegrating tablets: developments, technologies, taste-masking and clinical studies. Critical Reviews™ in Therapeutic Drug Carrier Systems, 2004; 21(6).

10. Barbosa-Cánovas GV, Juliano P. Physical and chemical properties of food powders. In Encapsulated and powdered foods, 2005 May 26 (pp. 51-86). CRC Press.
11. Levis RJ, Menkir GM, Rabitz H. Selective bond dissociation and rearrangement with optimally tailored, strong-field laser pulses. Science, 2001 Apr 27; 292(5517): 709-13.
12. Albrecht W, Aronhime J, Chaurasia BP, Geier J, Guserle R, Hrakovsky J, Lauer C, Prajapati R, Kansal VK, Kumar PV, Hans-Juergen MI, inventors. Solid state forms of sofosbuvir. United States patent application US 15/318,385. 2017 May 18.
13. Ofori-Kwakye K, Osei-Yeboah F, Kipo SL. Formulation and quality evaluation of two conventional release tablet formulations. Int. J. Pharm. Sci. Review and Research, 2010; 4(1): 94-9.
14. Hancock GR, Crawter D, Fityus SG, Chandler J, Wells T. The measurement and modelling of rill erosion at angle of repose slopes in mine spoil. Earth Surface Processes and Landforms: The Journal of the British Geomorphological Research Group, 2008 Jun; 33(7): 1006-20.
15. Tadikonda MR. *Formulation and Evaluation of Emtricitabine and Tenofovir-Disoproxil Fumarate Immediate Release Film Coating Tablets* (Doctoral dissertation, CL Baid Mehta College of Pharmacy, Chennai).