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Research Article

COMPARATIVE QUALITY EVALUATION OF TWO BRANDS OF PARACETAMOL TABLETS OBTAINED FROM THE MARKET

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ABSTRACT

Introduction: Paracetamol tablets are very common over the counter (OTC) products among the patients as a good analgesics s. It is the drug of choice in patients that cannot be treated with non-steroidal anti-inflammatory drugs (NSAID), such as people with bronchial asthma, peptic ulcer disease, hemophilia, salicylate-sensitized people and children under 12 years of age, pregnant or breastfeeding women. **Objective:** The objective of this study was to compare the quality of the paracetamol tablet formulations those are locally available in India pharmaceutical market manufactured by various pharmaceutical companies with pharmacopeia standards**. Materials and Methods**: The two popular brands (A & B) of paracetamol conventional tablet of 500 mg strength were chosen. The paracetamol tablets were obtained from the local medical shops. To compare the quality of tablet formulations of different brands various official parameters like friability, hardness, weight variation, disintegration time and dissolution were performed as per the standards mentioned in pharmacopoeia. **Result and Conclusion:** The result of all these parameters of different brands was in the Pharmacopoeial limits so it could be concluded that marketed pharmaceutical tablets of paracetamol of these brands are safe, effective and efficacious.

Keywords: Paracetamol, tablets, Evaluation, Market brands.

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INTRODUCTION

Tablets are a solid dosage form of drugs with or without excipients which are prepared by compression method. According to the Indian Pharmacopoeia tablets are solid, flat or biconvex unit dosage form of a medicament alone or medicament along with excipeints prepared by compressing technique. They may vary in its size shape and weight depending on the medicament and its mode of administration. Tablets are said to be most widely used conventional dosage forms due to its variety of advantages and 70% of the medicaments were dispensed in tablet forms. Most of the medicaments can be processed into tablets but there are some exceptions like medicaments with low density characters, hygroscopic and the medicaments which were not possible to administer.

Paracetamol or acetaminophen is active metabolites of phenacetin .It is a widely used over-the-counter analgesic and antipyretic. Chemically, it is 4-hydroxy acetanilide (acetaminophen). [1] [2] Paracetamol is approved for reducing fever in people of all ages. It is commonly used for the relief of headaches, other minor aches, and pains, and is a major ingredient in numerous cold and flu remedies. Paracetamol is used for the relief of pains associated with many parts of the body. It has analgesic properties comparable to those of aspirin, while its anti-inflammatory effects are weaker. It is better tolerated than aspirin in patients in whom excessive gastric acid secretion or prolongation of bleeding time may be a concern. Available without a prescription, it has in recent years increasingly become a common household drug. [3]

It is classified as a non-steroidal anti-inflammatory drug (NSAID) by some sources, and not as a NSAID by others, while most sources implicitly distinguish them, for example by mentioning both NSAIDs and paracetamol in the same sentence.[4] [5] [6] Paracetamol has few anti inflammatory effects in comparison to NSAIDs. However, aspirin, paracetamol and other NSAIDs all act by the same mechanism (inhibition of prostaglandin synthesis by inhibiting cyclooxygenase (COX)) and all show varying levels of analgesic, anti-inflammatory, antipyretic and antiplatelet actions. [7] [8] [9]

Regarding comparative efficacy, studies show conflicting results when compared to NSAIDs. A randomized controlled trial of chronic pain from osteoarthritis in adults found similar benefit from paracetamol and ibuprofen. [10] [11] Paracetamol is generally safe for human use at recommended doses. However, overdoses of paracetamol can cause potentially fatal liver damage and in rare individuals, a normal dose can do the same.

As defined by the International Organization for Standardization (ISO) 8402-198, quality is "the totality of features and characteristics of a product or service that bears its ability to satisfy stated or desired needs". [12] In order to fulfill these needs there should be a quality control mechanism in the production process. A quality control of drugs and drug products covers all measures taken, including the setting of specification sampling, testing and analytical clearance to ensure that starting material, intermediate, packaging materials and finished pharmaceutical product, identify the strength and purity of the drug.[13] The safety and efficacy of a pharmaceutical dosage form can be guaranteed when its quality is reliable.[14] Weight variation, content uniformity, thickness, hardness, friability, disintegration, and dissolution should be considered for validation of a tablet. Moreover, quality control parameters also or physical properties of tablet are useful tools for maintaining consistency in batch-to-batch manufacturing and it should be performed for every drug product. All of these parameters are closely related to each other and have effect on drug absorption, bioavailability etc. The aim of the study was to evaluate the comparative quality control parameters between the tablets of two brands of a formulation because standard quality parameters are essential for better quality of medicine.

MATERIALS AND METHODS

Two brands (A & B) of paracetamol tablets with label claim of 500 mg were purchased from city local medical stores. Finally the two different brands were taken for evaluation.

Chemicals

Potassium-di-hydrogen phosphate, Sodium hydroxide and Distilled water. All chemicals used were of analytical grade.

Equipments

UV Visible Spectrophotometer (Chrom One), Digital Balance (Wensar Weighing Pvt.ltd.), Friability Apparatus (HICON), Disintegration Test apparatus (HICON), Dissolution Test Apparatus (HICON), Pfizer Hardness tester (HICON) and pH meter (Systronics) were used.

Methods

The study used Indian Pharmacopoeia 2018 to check the in vitro quality of Paracetamol tablets using different analytical techniques and procedure described in the pharmacopoeia.

PROCEDURE OF EVALUATION

Various analytical methods and tests are important for the development and manufacture of pharmaceutical formulations. For the evaluation, following quality control tests were performed for both the tablet brands in the study. [15] [16]

Dimensional Parameters: The thickness and diameter of tablets were determined using digital Verniar Caliper.

Weight Variation: 20 tablets were taken and were weighed using high precision weighing machine. Their average weight was noted down. Then each tablet was weight and their percent deviation from the average weight was determined.

Hardness Test

A tablet was placed vertically on the Monsanto hardness tester. The load was then applied along the radial axis of the tablet. The weight or load required for breaking the tablet was noted down. Similarly it was done for 10 tablets.

Friability [17]

It was performed using Roche Friabilator. 10 tablets were weighed and placed in apparatus. The apparatus was rotated at a speed of 25 rpm. The apparatus was made to rotate for 4 min. The tablets were then weighed and the weights were compared with the initial weights.

The percentage friability was calculated using the formulas given in (Equation 1).

$$\% F = [1 - (W/Wo)] \times 100 \quad (1)$$

Where, % F = Friability in percentage,
Wo = Initial weight of tablets,
W = Weight of the tablets after revolution.

Tablet Disintegration [17]

It was performed using USP disintegration device. 6 tablets were placed in Disintegration test apparatus. It was maintained at 37 ± 0.2^0C containing distilled water. The time taken for a tablet to disintegrate was noted down.

Tablet Dissolution [18] [19]

For this test U.S.P. Type- 1 (Basket) Apparatus was used. Phosphate buffer (pH 5.8) as Dissolution Medium: The tablets were immersed into 900 ml. of Dissolution medium, the temperature of the dissolution medium was maintained at 37 ± 0.2^0C. The basket was rotated at a speed of 50 rpm. At 5, 10, 20,30,45,60 minutes 1 ml. of the medium was pipette out and replaced with fresh medium (Phosphate buffer pH 5.8). This was continued all along for 1 hour. The pipetted out samples were then diluted to 10 ml. with fresh dissolution medium and were then filtered. The absorbance of the filtered samples was determined using U.V. Spectrophotometer at λmax 243 nm.

RESULT AND DISCUSSIONS

Dimensional Parameters: The experiment is conducted to test the uniformity of the tablets in the aspects of thickness and diameter. Based on our result, the average thickness of Brand A tablets is 4.14 mm, as the thickness obtained for each 10 tablets lies within the range of 4.07mm to 4.19 mm and the average thickness of

Brand B tablets is 4.35 mm, as the thickness obtained for each 10 tablets lies within the range of 4.31mm to 4.39 mm. The result shows small value of difference which indicate the tablets are uniform in their thickness. Although thickness of tablets is not included in the pharmacopoeia standards, but it is important to be evaluated as it is one of the methods to control the quality for tablet packaging. Thickness can be varying with no change in weight due to difference in density of granulation; pressure applied, as well as speed during tablet compression. (**Table 1a and Table 1b)**

Table 1a: Thickness and Diameter

Brand (A) Tablets				
S.No	**Diameter**	**Average Diameter**	**Thickness**	**Average Thickness**
1	12.76 mm	12.74 mm	4.07 mm	4.14 mm
2	12.75 mm		4.18 mm	
3	12.73 mm		4.12 mm	
4	12.74 mm		4.15 mm	
5	12.75 mm		4.16 mm	
6	12.75 mm		4.14 mm	
7	12.72 mm		4.16 mm	
8	12.73 mm		4.19 mm	
9	12.73 mm		4.11 mm	
10	12.75 mm		4.16 mm	

Table 1b: Thickness and Diameter

Brand (B) Tablets				
S.No	**Diameter**	**Average Diameter**	**Thickness**	**Average Thickness**
1	12.63 mm	12.62 mm	4.34 mm	4.35 mm
2	12.61 mm		4.32 mm	
3	12.61 mm		4.31 mm	
4	12.64 mm		4.34 mm	
5	12.62 mm		4.34 mm	
6	12.63 mm		4.37 mm	
7	12.61 mm		4.37 mm	
8	12.62 mm		4.33 mm	
9	12.63 mm		4.39 mm	
10	12.61 mm		4.35 mm	

Weight Variation: During the study, at first the weight variation which is the key to controlling crushing strength and friability of tablet was assessed. The test stated that both the samples of paracetamol brands , A & B have passed the weight variation uniformity test as specified in the Indian Pharmacopoeia2018 (not exceed 5% deviation). (**Table 2)**

Table 2: Weight Variation

S. No.	**Name of Brand = A**		**Name of Brand = B**	
	Avg. weight of tablets= 598mg		**Avg. weight of tablets= 633mg**	
	Wt. of individual tablets (mg)	**% Deviation**	**Wt. of individual tablets (mg)**	**% Deviation**
1.	605	1.17	643	1.5
2.	609	1.8	624	1.42
3.	592	1.0	634	0.16
4.	593	0.83	633	0
5.	610	2.0	640	1.1
6.	601	0.5	635	0.31
7.	595	0.5	634	0.16
8.	586	2.0	635	0.31
9.	612	2.34	628	0.78
10.	602	0.66	631	0.31
11.	605	1.17	635	0.31
12.	601	0.5	629	0.63
13.	597	0.16	626	1.1
14.	595	0.5	629	0.63
15.	591	1.17	630	0.47
16.	592	1.0	638	0.78
17.	601	0.5	638	0.78
18.	586	2.0	629	0.63
19.	604	1.0	632	0.16
20.	596	0.33	636	0.47

Hardness: Hardness is the second most important physical feature for assessing tablet. In the study, it was found that both brands of paracetamol group passed the test of tablet crushing strength or hardness. Both these brands have acceptable crushing strength of between 4 kg/cm2 to 10 kg/cm2. (**Table 3)**

Table 3: Hardness (kg/cm^2)

S.No.	Brand (A) Tablets	Brand (B) Tablets
1.	10	7
2.	10.2	6
3.	8.4	8.2
4.	10.1	6
5.	8.3	6
6.	9	8.2
7.	8.3	8
8.	8.2	6
9.	8	6.2
10.	8.4	6.4

Friability: In the friability test, both tablet brands showed impressive friability values. The friability values for both paracetamol tablet brands were ranged from 0.1 to 0.5%. In both formulations the percent (%) Friability was less than 1% which ensures that all the tablets of both brands of formulation were mechanically stable. (**Table 4)**

Table 4: Percentage Friability

S.No	Brand Name	Percentage Friability
1	**Brand (A) Tablets**	**0.15**
2	**Brand (B) Tablets**	**0.46**

Disintegration Time: The disintegration time of both tablet brands of paracetamol was satisfactory as uncoated tablets have disintegration time standards less than 5 minutes. (**Table 5)**

Table 5: Test for Disintegration

S.No	Brand Name	Disintegration Time
1	**Brand (A) Tablets**	1 min 03 secs
2	**Brand (B) Tablets**	1 min 50 secs

Dissolution: Dissolution was another studied important quality control parameters directly related to the absorption and bioavailability of a drug. The study revealed that at different time intervals drug release rate was better. After 10 minutes, the release rate of both tablet brands of paracetamol was 49% to 55.2%. Finally after 60 minutes, 72.5% to 83% drug release was observed in both the paracetamol brands. Comparative outcome of the test has been shown in (**Table 6)** and (**Figure 1).**

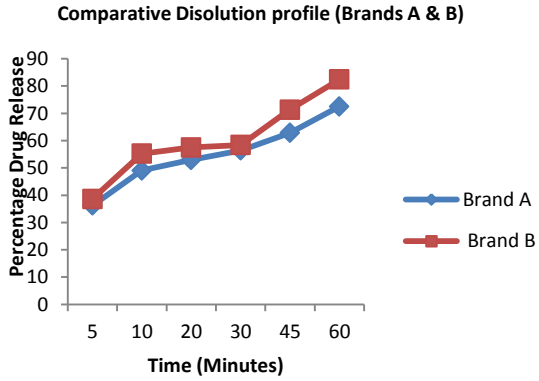

Table 6: Test for Dissolution

Brand Name	% Drug Release (5 mins)	% Drug Release (10 mins)	% Drug Release (20 mins)	% Drug Release (30 mins)	% Drug Release (45 mins)	% Drug Release (60 mins)
Brand (A) Tablets	**36.2**	**49**	**52.9**	**56.3**	**62.8**	**72.5**
Brand (B) Tablets	**38.6**	**55.2**	**57.5**	**58.3**	**71.3**	**82.3**

CONCLUSION

Paracetamol is a well established and proven analgesic and antipyretic drug. Therapeutic response of any formulation depends on its quality parameters. From the study it was identified that weight variation and friability test of both paracetamol tablet brands complied the specification. Variation was obtained in hardness, disintegration time and dissolution profile during the test procedure. It should be strictly considered that an ideal tablet will have sufficient hardness to maintain its mechanical stability but not more. Because harder tablet can delay disintegration time or alter dissolution profile. Finally, as quality control parameters are related to one another from initial step to pharmacological action of the drug, a high-quality tablet should meet all the standard quality parameter for getting its desired therapeutic response.

CONFLICT OF INTEREST

The author declares that he has no competing interests.

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