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Different Processing and Formulations Affect Aspirin Dissolving Rate

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Abstract: Since it is one of the most crucial quality control tests carried out on pharmaceutical dosage forms and is currently turning into a tool for prediction, most research have employed dissolving test. bioavailability, and occasionally substituting clinical research to establish bioequivalence. Drug pharmacological action is substantially influenced by their dissolution behavior. Actually, it has been shown and usually referred to as in vitro-in vivo correlation, IVIVC, a direct association between in vitro dissolution rate of several medications and their bioavailability. We tried to gather numerous studies and profit from past experiences in an attempt to investigate the possible alterations that might increase the bioavailability of aspirin, lower gastrointestinal side effect and offer a fast effect in our study. Our investigation was planned practically, and the cornerstone of our approach was a dissolution test. The course of research was altered during the COVID-19 epidemic to a theoretical review. The aim of the study is to provide prospective studies with the necessary information that reflect the effect of formulation changes on the in vivo performance by means of excipients and dosage form formulations, so exploring, in a comparative manner, their impact on aspirin's dissolution rate.

Key Words: aspirin, dissolving, coated tablet, dose form

1. INTRODUCTION

With around 35,000 tons produced and consumed yearly, aspirin—also known as acetyl salicylic acid (ASA)—is among the oldest and most often used medications available worldwide [1]. Treating fever, pain, and bodily inflammation, it is a non-steroidal anti-inflammatory medicine (NSAID). Aspirin is used at low doses to prevent heart attacks, strokes, and blood clot development in those at great risk [2]. Furthermore mounting data point to a lower incidence of cancer development linked to consistent aspirin use [3]. As aspirin reduces symptoms, including pain, the alleviation comes at the price of significant side effects and medication resistance. Several research conducted so lately shown that the therapeutic and adverse effects of the drug might be influenced by several elements including formulation, excipients and manufacturing technique. In clinical pharmacology and drug behavior, aspirin research produced fascinating findings. On individual patients, however, the existing tests have little specific value in terms of consistently predicting medication effect or direction of therapy advice. To get such results [4], [5], prospective laboratory studies are essential. Developing novel medicinal products in the pharmaceutical sector makes extensive use of dissolution experiments [6]. It can also be used to evaluate batches and as a reference to create new and current formulations as well as to maybe examine the effects of specific formulation adjustments. From a quality assurance perspective, a more discriminative dissolving technique is desirable since the test will show any changes in the quality of the product before in vivo performance is impacted [7], [8].

Most of the publications, studies, reviews, technical reports, and other original papers we found suggesting various aspirin formulations directly or as part of a bioequivalence test directly or as part of a dissolving test, Table 1. Published in 2001, a paper in Pharmaceutical Technology showed a quite basic ASA formulation combining partly pregelatinized starch with microcrystalline cellulose. While starch gives the required dissolving properties to the formulation, microcrystalline cellulose offers the compatibility required for manufacturing a tablet for aqueous enteric film coating. For formulations with appropriate excipients, dissolution test showed that more than 80

By direct compression technique employing super disintegrants, Meenakshi K. D and colleagues developed novel

aspirin tablets with best physicochemical characteristics for increased compliance and delicious melt in mouth in 2011. They came to the conclusion that, in compared with the existing tablet formulation of aspirin, the new aspirin formula generated quick dissolving tablet [12].

Using less excipients (lactose, corn starch and aerosi) and to compare this formulation with the other brands, a study attended to create aspirin tablets by direct compression method in University of Karachi. Few excipients may be the reason dissolving of trial batches was determined to be better than most commercial brands assessed as one of the evaluation tests. Fast breakdown of tablets encourages strong dissolving rates [13]. For possible improvement in the start of action for acute pain therapy, a new 500 mg aspirin tablet formulation including micronized active ingredient and an effervescent component has been created in the beginning of the last decade. The dissolution and pharmacokinetics of the new formulation in respect to conventional aspirin tablets, aspirin granules, aspirin effervescent tablets are presented in this work. Dissolving the micronized aspirin tablet formulation improved results more than using the aspirin regular tablet at 15 minutes [14].

Designed as a fast- acting and quick-dissolving solid dosage form for regular daily usage in avoiding myocardial infarction and cardiovascular events, a new orally disintegrating tablet formulation of low-dose ASA (81 mg) was developed. Rojeab y. Aiming to assess the in vitro dissolving properties and ASA absorption kinetics from the new product, et al. Low-dose ASA's oral disintegrating tablet form distinguished by quick dissolving above other formulations [15].

Using Methocel, NaHCO3, Ethocel, Aerosil, and dicalcium phosphate anhydrous as excipients, aspirin floating tablets were produced (to improve the bioavailability) via a direct compression technique. Several techniques were used to analyze tablets. By means of USP equipment II, in vitro dissolution investigation was conducted; the results revealed that "the dissolution of aspirin was influenced by the excipients in the tablet" [16].

A specific work emphasized on the formulation and development of sustained release dosage forms for the management of different chronic diseases, especially investigating the impact of polymers on the sustained activity. We worked on the dissolution for eight hours. This was done to obtain an in vivo condition simulated picture of drug release. In this work Karim et al. showed that the introduction of polymers in the formulation sustained the pattern of release. The qualities and quantity of polymers employed clearly affected the release characteristics; it was clear that hardness rose as concentration of polymers rose [17].

Seven kinds of ASA (300 mg) tablets were bought from several Benin City, Edo State, Nigerian pharmacies. Part of quality control, all ASA tablet brands passed the disintegration test. Within 45 minutes, results revealed that seventy percent of the drug—from various brands—was eliminated. Since the rate and extent of the medication absorbed depend on the dissolution rate of drug particles [18], [19], dissolution test indicates of evaluating the bioavailability of pharmaceuticals.

2. DISCUSSION

Among several ways of drug delivery, the oral route is the most often employed for systemic drug delivery via pharmaceutical dosage forms comprising the standard and innovative drug delivery systems [20]. Because of its simplicity of usage, patient acceptance, and affordable manufacturing technique, natural, straightforward, safe oral route of drug delivery is most often utilized [21]. Low-dose aspirin is routinely used today in preventing myocardial infarction and cardiovascular events and its main adverse effects are the gastrointestinal disturbances and ulcers when administered orally and to lower the adverse effects; hence, it can be formulated as sustained release, which could provide a more constant plasma concentration with less frequent administration. Because aspirin has limited solubility in water (1:300) [22], [23], dissolution is one of the key limiting step in their absorption and bioavailability [24], [25]. A main obstacle of pharmaceutical formulation activity is raising the efficacy of the product by attaining faster dissolving and faster absorption which may lead to a faster beginning of action in acute pain [26]. In the pharmaceutical sector as well as in quality control processes, dissolution testing is an indispensable part; it guarantees that the final solid dose forms have consistent dissolve characteristics. Following all the studies, we discovered that dissolution rate was influenced by every experiment. These results coincided with the knowledge of how drug formula (excipients) influences dissolving rate. Clearly seen and matched with the rise in drug release seen in micronized tablets (14) and orally disintegrating tablet (this is because the formed ASA-containing solution/suspension will start getting absorbed from the oral cavity first) [27]. The effect of dosage form on dissolution rate was obvious. The release rate dropped as polymers increased while sustain released tablet produced with varying concentrations of Ethyl cellulose and hydroxypropyl methyl cellulose [28]. One of the most crucial bioequivalent tests is the dissolving test; by varying aspirin brands, several studies revealed that all the brands produced the same findings and dissolution rate came to satisfy all the brands.

3. CONCLUSION

One of the most crucial quality control procedures applied to estimate drug bioavailability, ascertain bioequivalency, and ascertain the impact of formula and comparison between several dosage forms is the dissolution test.

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	Invention disclosed	Year ofpublic ation	Type of apparatus	Media	Method of tablet manufacturing	Dosage form	Formula (additives)
[9]	Formulation of Acetylsalicylic Acid Tablets for Aqueous Enteric Film Coating	2001	USP Apparatus I (Basket)	acetate buffer (pH=4.5)	Compression and coating	enteric film coated tablet	Aspirin Stearic acid, starch Microcrystalline cellulose Croscarmellose sodium Sodium starch glycolate
[10]	Preparation and Characterization of Aspirin-Chitosan Complex: An Attempt for Its Solubility and Stability Improvement	2010	axed in a molar ratio of (1:1)	dissolved in 500 ml of purified water	simple mixing of previously dried aspirin and chitosan powders	1:1 aspirin chitosan HCl mixture	Aspirin chitosan hydrochloride salts
[12]	Design of aspirin formulation for rapid pain relief	2011	USP type-II apparatus (paddle)	500 ml of phosphate buffer (pH 4.5)	Direct compression	Fast dissolvin g tablet	Aspirin, iodine214, iodine254, mannitol croscarmellose, talc microcrystalline cellulose,
[13]	FORMULATION OF ASPIRIN TABLETS USING FEWER EXCIPIENTS BY DIRECT COMPRESSION	2011	USP type-II apparatus (paddle)	0.05M acetate buffer solution 500 mL (pH 4.5) at 50 rpm	Direct compression	Rapid release tablet	Aspirin Lactose, CornstarchAerosil
[14]	Dissolution of micronized aspirin formulation	2011	USP general test	pH of 4.5.	Direct compression	microniz ed Tablet	micronized aspirin
[15]	in vitro dissolution of ASA from a new orally disintegrating tablet formulation of low dose ASA (ODA)	2011	USP apparatus II (paddle method)	0.1 N HCl	Direct compression	orally disintegr ating tablet	Starch, Croscarmellose sodium, Hypromelloses, Cellulose, Corn, Microcrystalline, Mineral oil, Titanium Dioxide
[16]	In vitro release modeling of aspirin floating tablets	2015	USP apparatus II (paddle method)	SGF without pepsin pH 1.2	Direct compression	floating tablet	Aspirin Methocel K4M CR, NaHCO3, Ethocel, Aerosil, Dicalcium, phosphate anhydrous
[17]	In Vitro Evaluation of Aspirin Sustained Release Tablets Using Hydrophilic Polymer	2016	USP apparatus-II (paddle)	phosphate buffer, pH 6.8	Direct compression	sustaine d release dosage forms	Aspirin, Ethyl cellulose HPMC-K15 MCR, Lactose povidone K-30 magnesium stearate
[18]	Comparative Study of The Physicochemical Properties and Dissolution Profiles of Some Brands of Acetylsalicylic Acid Tablets Marketed In Benin City, Edo State, Nigeria	2019	USP dissolution apparatus (rotating basket)	(800 ml of 0.1N HCl)	Direct compression	Coated tablet	AxA (1) Biophar ma ASA (2) Emprin ASA (3) Kunimed ASA (4) Disprin ASA (5) Anacin ASA (6) Aspirin caplet ASA (7) Propon (Seven different brands)

TABLE 1: overview of studies

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