A STUDY ON EFFECT OF PHYSICAL PROPERTIES ON THE QUALITY OF FORMULATIONS OF DIFFERENT PHARMACEUTICAL COMPANIES
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ABSTRACT
Tablets and capsules represent unit dosage forms in which one usual dose of the drug has been accurately placed. The present study reports the quality evaluation of tablets of two different Pharmaceutical Companies and its comparison. The tablets: Niacinamide, Ferrous Fumerate, Paracetamol in combination with Ibuprofen, Nimesulide and Ciproflaxacin were collected from two companies with their consent for quality evaluation and analysis. The tablets collected were subjected to different post-formulation tests such as Weight variation, Hardness and Disintegration rate, following standard I.P procedures. The observations were recorded and various plots have been drawn to correlate the above said parameters. From the results, it was noticed that there was no much difference in the Disintegration rate but considerable variation in the pattern of weight variation and Hardness of these companies because of change in recipients and due to the presence of other drugs. However, it could be concluded that the product formulations of company ‘Y’ are seen to be more reliable than company ‘X’.

KEY WORDS: Quality evaluation, Weight variation, Hardness, Friability, Disintegration rate, dissolution rate and recipients

INTRODUCTION:
The oral route is the most important method of administering drugs for systemic effects. Except in case of insulin therapy, the parenteral route is not routinely used for self-administration of medication. The topical route of administration has only recently been employed to deliver drugs to the body for systemic effects, but is limited in its ability to follow effective drug absorption for systemic drug action. The parenteral route of administration is important in treating medical emergencies. Nevertheless, at least 90% of all drugs used to produce systemic effects are administered by the oral route. Of drugs that are administered orally, solid oral dosage form: Tablets and capsules are preferred as represent unit dosage forms whereas liquid oral dosage forms such as syrups, suspensions, emulsions, solutions and elixirs are usually designed to contain one dose of medication in 5 to 30ml. To design tablets and later monitor tablet production quality, quantitative evaluations and assessments of a tablet's chemical, physical and bioavailability properties must be made. The standard quality control tests such as Diameter, size and shape, Uniformity of weight, Thickness, Hardness, Friability, Percentage of medicament, Rate of disintegration, Dissolution and Solubility can be carried out on compressed tablets for their evaluation. In the present work, five different drugs of tablets from each of the companies X and Y are collected and the quality control tests cited above were conducted in order to study the effect of composition of formulations in drug release rate [1].

PREVIOUS WORK:
D.K. Singh, R. A. Singh and et al described methods for dissolution tests of Ibuprofen and Paracetamol tablets in single active ingredient formulation. The two compounds have well differential spectra so multi compound U.V.- Visible analysis of formulation containing both compounds should not be difficult an accurate selective and simple method for invitro dissolution of Ibuprofen and Paracetamol formulation containing both the compounds have been developed. The method has been applied successively to pharmaceutical preparations (tablets) containing Ibuprofen and Paracetamol in combination without prior separation of Ibuprofen or Paracetamol [2]. M.Narayana Reddy, K.Sasira Reddy et al developed two simple spectrophotometric methods for the determination of Nimesulide. They are based on the formation of coloured condensation products with aromatic aldehyde namely Paradimethyl amino cinnalaldehyde (PDACA) exhibiting maximum absorption at 525nm and the second method is based on the complex formation with 1,10-Phenanthroline (1,10-PTL) and Fe (III) exhibiting maximum absorption at 490nm [3]. S.Kanna Babu, P. Udhay Shankar et al described a simple spectrophotometric method for determination of Ciproflaxacin in its pharmaceutical formulations based on the reaction of Ciproflaxacin with Rosebengal (C.L. No.4540) and with hydroxyl ions which contain maximum chlorides to heal a pink coloured chromogen which exhibits an absorption maximum at 575nm chromogen which is stable for 50minutes and Beer's Law is obeyed in the concentration range of 2 mcg / ml to 10mcg/ml [4]. D.K. Vatsa, A.K. Marwah and et al used a method of Orthogonal polynomials in estimation of ciprofloxacin in pharmaceutical dosage forms. The quadratic polynomial coefficient was computed by measuring the floresense of the drug in 0.01N Hydrochloric acid at 10 points equally spaced at 5nm levels with an emission espectrum from 125 to 170nm the quadratic polynomial coefficient was observed to be directly proportional to the
concentration in the range 0.5 to 2.0 mcg [5]. Dr. K.P.R. Chowdary, Y. Susela Devi and et al. studied the improvement in dissolution rate of Nimesulide. Solid dispersions of Nimesulide in polyvinyl pyrrolidone (PVP), Polyethylene glycol (PEG) dextrin (DX) and pre-gelatinized starch (PGS) were prepared and evaluated for dissolution rate and efficiency. Solid dispersions in water insoluble excipients (PVP and PEG), PGS gave highest dissolution rate and efficiency of Nimesulide. Dissolution of Nimesulide from the dispersions obeyed Hixson-Crowell's cube root equation [6].

K.E.V. Nagoji, Dr. S. Srinivasa Rao and et al. developed two new spectrometric methods for the estimation of Nimesulide. Nimesulide produces yellow colour with 0.2N acetic acid and 0.2N sodium carbonate and shows maximum absorbances at the wavelengths of 431nm and 433nm respectively. The drug in the formulations is estimated by two methods A and B. In the method A the drug in the formulations is directly dissolved in 0.2N acetic acid and estimated. In method B the drug in the formulations is directly dissolved in 0.2N sodium carbonate and estimated. The results obtained by both the methods are compared with those obtained by the reported U.V. spectrophotometric method. Both methods obey Beer's law in the concentration range of 1 to 30 micro - gram per ml [7]. Sadana, J. Rajput and Gitanjali Randive et al. developed two spectrophotometric methods A and B for the estimation of Nimesulide. In method A the drug is dissovled in DMF to get a yellow coloured solution having maximum absorbance at 436nm the drug is diazotiated after reduction then coupled with N - (Naphthyl) ethylene diamine dihydrochloride (NED) solution to get a simple chromogen which has maximum absorbance at 557nm. Beer's law is obeyed in the concentration range of 1 to 12mcg per ml for method A and B respectively [8]. T.E.G.K. Murthy, Y.A. Chowdhary et al. evaluated four commercially available brands of Nimesulide (ABC & D) in the Indian market for four invitro parameters viz. Uniformity of weight, disintegratin, drug assay and dissolution. The results of the investigation revealed that all though all the tablets fulfilled all official specifications including dissolution rate. Most products however differed in dissolution profile as well as disintegration time all most all the products follow first order kinetics [9].

Dr. K.P.R. Chowdary, A. Radha Rani et al. formulated Nimesulide suspensions employing its solid dispersions in PVP, PEG and pre-gelatinized starch (PGS) and studied. Suspensions formulated with dispersions in PGS gave highest dissolution rate of Nimesulide [10]. A. P. Kakkar prepared discrete free flowing micro-capsules of Ibuprofen having good spherical geometry and smooth surface using sodium alginate as coating material and calcium chloride as gelling agent. Results of studies showed that mean diameter recovery, encapsulation efficiency, wall thickness, size distribution and release characteristics of micro-capsules were influenced by sodium alginate concentration. Surface characteristics of micro-capsules were investigated by Scanning Electron Microscopy [11]. K. P. R. Chowdhary and Buchi N. Nalluri studied the solubility and dissolution rate of Nimesulide from two formulations at various pH’s (1.2, 6.2, 7.4 and 8.4) to evaluate the effect of pH. Both the solubility and dissolution rate were increased as the pH increased from 1.2 to 8.4. A 51 fold increase in the solubility and 42 and 7 fold increase in the dissolution rate respectively with laboratory made and commercial formulations was observed in alkaline borate buffer (pH 8.4) when compared to purified water pH 6.2. A good correlation was found between solubility and disintegration rate of Nimesulide (r=0.98-0.99). Dissolution of Nimesulide in various fluids followed first order kinetics [12].

MATERIALS AND METHODS:

MATERIALS:
The following five different tablets from each of the companies X and Y were collected and the quality control tests cited above were conducted.

Company X: a) FLORIGUARD - B (coated) consisting of Niacinamide [14], b) GLYZIRON - C (coated) consisting of ferrous Fumerate, c) I.P.M. forte (uncoated) consisting of paracetamol and Ibuprofen, d) NIMSUN (uncoated) consisting of Nimesulide and e) CIPROSUN (film coated) consisting of Ciprofloxacin.

Company Y: a) NEUROSOL (coated) consisting of Niacinamide, b) REDISULES (coated) Consisting of Ferrous Fumerate, c) FENCIN – M.R (uncoated) consisting of Paracetamol and Ibuprofen, d) NIMESULIDE (Uncoated) consisting of Nimesulide and e) MITYCIP – 500 (Coated) consisting of Ciprofloxacin.

Instruments: Monsanto Hardness tester, Disintegration apparatus B.P. standard (Campbell), Electronic balance (DHONE).

Chemicals: Phosphate Buffer solution, 0.1N Hydrochloric acid, Glacial Acetic acid, Ceric Ammonium sulphate, Per Chloric acid, Sodium hydroxide, 95% Ethanol

METHODS:

Weight variation test: For carrying out this test 20 tablets at random were taken and weighed. The average weight was calculated, then each tablet was weighed individually and weight was noted. The weights of individual tablets were then compared with the average weight calculated and saw that not more than two tablets fall outside the range [13].

Hardness test: Hardness can be defined as the strength of the tablet to withstand the pressure applied. The tablet to be tested was held between a fixed and a moving jaw of Monsanto Hardness Tester. The force applied to the edge of the tablet was gradually increased by moving the screw knob forward until the
tablet breaks. The reading was noted from the scale which indicates the pressure required to break the tablet. The hardness of a tablet depends on the weight of the material used, space between the upper and lower punches at the time of compression and pressure applied during compression. The hardness also depends on the nature and quantity of recipients used during formulation. If the finished tablet is too hard, it may not disintegrate in the required period of time and if the tablet is too soft it may not withstand the handling during packing and transporting [14].

**Disintegration test:** The disintegration tests are performed to find out within how much time the tablet disintegrates as it is very important and necessary for all the tablets, coated or uncoated to be swallowed because the dissolution rate depends upon the time of disintegration, which ultimately affects the rate of absorption of drugs. Tablets were introduced into each tube of disintegration test apparatus and a disc was added to each tube. The assembly was suspended in the beaker containing the specified liquid and operated for specified time. The assembly was removed from the liquid after all the tablets have been disintegrated. If 1 or 2 tablets fail to disintegrate, the test on 12 additional tablets will be repeated until not less than 16 of the total of 18 tablets tested disintegrate. If the tablets adhere to the disc and the preparation being examined fails to comply, the test will be repeated omitting the discs [15].

**RESULTS AND DISCUSSION:**
Niacinamide, Ferrous Fumerate, and Paracetamol in combination with Ibuprofen, Nimesulide and Ciprofloxacin tablets of two different Pharmaceutical companies ‘X’ and ‘Y’ were collected for the quality analysis. Our objective was to find out the best composition by evaluating the quality of the tablets. The Post-formulation tests: Weight variation, Hardness and Disintegration rate have been carried out using the prescribed IP methods and standard instruments. After performing the tests the observations were recorded and various plots have been drawn correlating the above parameters. From figs. 1-5, it was seen that with the increase in weight content the hardness of the tablets was slightly increased without much variation in content uniformity of weight, but there was a considerable difference in the hardness of both the companies which might be due to the change in the excipients. However, the hardness test in case of X company formulation has shown a linear increase.

From Figs. 6-10, the disintegration rates of tablets have been decreased with increase in time with all the products of both the companies. From the above results, it was observed that the product formulations of company ‘Y’ have been better qualified in the tests rather than company ‘X’.

CONCLUSIONS:
From the studies, it was observed that there were considerable variations in the product formulations of both the companies with regard to weight variation and Hardness tests. As far as the standard test of Disintegration rate is concerned, the product of formulations of both the companies have shown the same pattern and are as per I.P. Standards. Since there exists a combination of other drugs in some of the formulations there was an effect of these drugs in performing the qualitative tests. However, it can be concluded from the results that the formulation ‘Y’ Company products are better than the products of ‘X’ company.

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