COMPARATIVE PHARMACOPOEIAL ANALYSIS OF SELECTED BRANDS OF DICLOFENAC SODIUM TABLETS AVAILABLE IN WESTERN UGANDA PHARMACIESBASED ON BP 2009

BY

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A RESEARCH REPORT SUBMITTED TO THE SCHOOL OF PHARMACYIN PARTIAL FULLFILMENT OF THE REQUIREMENT FOR AN AWARD OFBACHELOR OF PHARMACY DEGREEOF KAMPALA INTERNATIONAL UNIVERSITY

JUNE, 2017

DECLARATION

, **TUMWEBAZA JOHN MARTIN**, declare that this research report is a result of my own fforts and has never been submitted to any institution of higher learning for the award of a achelor's degree in Pharmacy. The views herein are my own, unless stated, and where such has een the case, acknowledgement or reference has been quoted.

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DEDICATION

dedicate this research report to my dear father and mother, Mr. and Mrs. Kasambula who have layed such a fundamental role in my life,financially, morally and spiritually. I have reached this ar because of their unconditional love and support in every kind of way. May the good Lord bundantly reward and bless themfor their great love and support and encouragement.

ACKNOWLEDGEMENT

would like to extend my gratitude to my supervisor Mr. Paul Rubayizafor his support and guidance.I lso thank Mr. Ivan Ibanda the laboratory technologist.

am indebted to my Dean and co-supervisor, Dr. Jonans Tusiimire for all his tiring work towards making iis project possible.

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LIST OF ABBREVIATIONS

API – Active Pharmaceutical Ingredient

AUC – Area under the Curve

BP – British Pharmacopoeia

Cmax – Maximum concentration

KIU-WC – Kampala International University Western Campus

MUST – Mbarara University of Science and Technology

NSAIDs – Non-steroidalanti-inflammatory drugs

NSAIAs – Non-steroidalanti-inflammatory agents

r – hour

ABSTRACT

Background: Diclofenac is one of the most commonly used non-steroidal anti-inflammatory drugs (NSAIDs) for the treatment of pain, rheumatism and other inflammatory conditions.**Aim:** This study was aimed at investigating whether the selected brands of diclofenac sodium meet their label specifications as well as the BP 2009.**Materials and Methods:** Three brands of Diclofenac sodium were randomly selected in Pharmacies of Ishaka-Bushenyi Municipality, Bushenyi. A total of 20 tablets of each brand were chosen and used for this study. Quantitative test(assay)based on UV-Vis spectroscopy as well as qualitative tests (weight variation,hardness and disintegration time test) were done. Information was recorded in duplicates and analysis conducted using MS Excel 2010 Version.**Results:** Diclofenac sodium tablets used in this study showedweight variations but there were no significant difference (P value > 0.05). Hardness test showed that brands D2 and D3 exhibited greater capability to resist breaking than D1 with hardness of **784.25N**, **629.12N** and **427.44N** respectively. The disintegration time test showed that brands D1 and D2 passed the test while brand D3 failed to pass in acidic medium according to the BP limits. The calibration curve was linear with correlation coefficient (r^2) of **0.9997** at concentration range of **5.00-30.00µg/ml**. According to BP specifications of **95-105%**, all the three brands failed the assay with a percentage stated content of **75.8%**, **89.1%** and **82.1%** for brands D1, D2, and D3 respectively.**Conclusion and Recommendations:** Within limitations of this study, brand D3 failed the disintegration time test in acidic medium. All diclofenac sodium brands failed the assay test because of using a low sonication time for extracting the API from the drug. Further tests should be carried out to validate the sonication time against absorbance to obtain an optimum time for extracting the API from the drug.

CHAPTER ONE: INTRODUCTION

1.1 Background

Diclofenac sodium is a NSAID. NSAIDs are a drugs that have analgesic (pain-killing), antipyretic (fever-reducing), and, in higher doses, anti-inflammatoryeffects.

Chemically, Diclofenac sodium is (2-[(2,6-dichlorophenyl) amino] benzene aceticacid 4-(3H-1,2,dithiol-3-thione-5-yl) phenyl ester) comprising a hydrogen sulfide releasing dithiol-thione moiety attachedby an ester linkage to Diclofenac (Zhang *et al.*, 2011).

According to McCarberg and Gibofsky, 2012, NSAIDs are among the most frequently prescribed drugs worldwide and are used for relief of inflammatory, chronic (e.g., rheumatoid arthritis, osteoarthritis, and gout), and acute (e.g., headache, postoperative pain, and orthopedic fractures) pain conditions.

Similar to other NSAIDs, diclofenac sodium is associated with rare, but serious and sometimes fatal; GI tract side effects such as ulceration and hemorrhage. Therefore, this drug is an ideal candidate for taking with food and incorporation with different macromolecules to diminish its adverse effects after oral administration and also increase its bioavailability (Nayak and Pal, 2011 and Barzegar-Jalali *et al.*, 2012).

Diclofenac sodium acts by inhibiting COX activity and consequently the formation of pro-inflammatory mediators such as prostaglandins (PGs) and thromboxanes (Vane JR, 1971). The mode of analgesic action of diclofenac sodium is through inhibition (COX-2) causing a reduction in the conversion of arachidonic acid into inflammatory prostaglandins (Morita I, 2002).

Like many other drugs, Diclofenac sodium absorption depends on type of food intake in conjunction with the time the drug is taken orally. It is easily and rapidly absorbed in the gastrointestinal tract after oral administration and also attains peak blood levels approximately after 2hours. Diclofenac undergoes first-pass metabolism andthe oral bioavailability of diclofenac ranges from 54to 90%. Diclofenac is highly bound to serumproteins ($\geq$ 99.5%) and it has a relatively lowvolume of distribution (0.12 to 0.17 L/kg) (Todd and Sorkin, 1988, Davies and Anderson, 1997).There are little data about the distribution ofdiclofenac into other tissues

ınd fluids. About this,diclofenac easily penetrates the synovial fluid andcross the placenta (Todd ınd Sorkin, 1988, Fowler PD*et al.*, 1983). However, diclofenac doesnot easily cross the blood-›rain barrier. It has beentested that the diclofenac concentrations incerebrospinal fluid are 8.22% ›f those in plasma(Zecca L, *et al.*, 1991).

Some of the complicating factors that affect the quality of the drug products are related to the quantity of active pharmaceutical ingredient (API) which mismatches with the label claim or ›ccasionally no API, unwanted excipient and impurity content (Green, 2015).

This study was aimed at a comparative pharmacopoeial analysis of selected brands of diclofenac odium tablet available in Western Uganda pharmacies.

.2 Problem Statement

The standard of Diclofenac sodium is supposed to correlate with that in the BP in terms of ontent, hardness, impurities and weight variation in order to attain effectiveness in therapy. \ccording to Chika, *et al*, 2011, there have been a vast number of fake drugs worldwide. There s a high predominance of low quality Diclofenac medicine (Ahmed, *et al,* 2015). Medication hat is substandard may lead to failure of therapy. Therefore this study was aimed at probing vhether the selected brands of Diclofenac sodium meet their label specifications as stipulated in 3P 2009.

.3 Justification of the study

Quality of diclofenac is of great importance for efficacy in treatment therapy. This is important › ensure efficacy, prevention of adverse drug reactions, minimize development of esistance/tolerance (due to down regulation) and therefore maintain health care costs at ffordable levels. There appears to be very little information on post market studies on Diclofenac tablets in Western Uganda. Lack of this information may lead to; serious health nplications,waste scarce resources and contribute to drug resistance. Also these brands greatly ary in priceson the market and there is need to evaluate the possibility of their prices being elated to their quality, stability and/or therapeutic efficacy.

This project was therefore aimed at assessing the differences in quality, efficacy among the selected brands of diclofenacsodium tablets.

.4 Objectives of the study

.4.1 General objective

To carry out a comparative pharmacopoeia analysis of three brands of diclofenac tablets sold in pharmacies in Western Uganda.

.4.2 Specific objectives

i. To evaluate whether the qualitative characteristics of the selected tablets meet BP specifications.
ii. To assess whether the chemical quantitative characteristics of the selected tablets meet BP specifications

.5 Research questions

i. Does the qualitative characteristic of the selected tablets meet BP specifications?
ii. Does the chemical quantitative characteristic of the selected tablets meet BP specifications?

CHAPTER TWO: LITERATURE REVIEW

2.1 Overview about tablets

A tablet consists of one or more drugs (APIs) as well as a series ofother substances (excipients) used in the formulation of a complete preparation.In the European Pharmacopoeia (2011), tablets are defined as 'solid preparations each containing a single doseof one or more active substances.'

Tablets are obtainedby compressing uniform volumes of particles or byanother suitable manufacturing technique, such asextrusion, moulding or freeze-drying (lyophilization).They are intended for oral administration.Some are swallowed whole, some arechewed, some are dissolved or dispersed in waterbefore being administered and some are retained inthe mouth where the active substance is liberated.Thus, a variety of tablets exists, and the types of excipients and also the way in which they are incorporatedin the tablet vary(Aulton & Taylor, 2013).

The different categories of tablets include; coated tablets (including film coated and sugar coated tablets), soluble tablets, dispersed tablets, effervescence tablets, and chewable tablets, tablets for use in the mouth including sublingual and buccal tablets.

2.2 Diclofenac sodium tablets

Diclofenac sodium is a prototypical Non-steroidal anti-inflammatory agent (NSAIA); phenylacetic acid derivative (Novartis, 2006 and Reynolds, 1989); structurally related to meclofenamate sodium and mefenamic acid (Hamor, 1989). Diclofenac sodium has been marketed since 1973 (Todd &Sorkin,1988 and Senguptaet *al.*, 1985). It has been approved in theUnited States (Ciba-Geigy, 1988). Experimental and clinicalfindings obtained to date have indicated that diclofenacsodium was synthesized on well-founded principles(Sallmann, 1986).Tablets of diclofenac sodium are round, biconcave, enteric coated and are in a dosage of 100-150mg daily given as 50mg 2 or 3 times daily(Novartis, 2006).

clofenac sodium enteric coated are not recommended for relief of acute pain (Todd Sorkin,1988), or primary dysmenorrhea (Novartis, 2006) because of slow onset of tion(Willis *et al.*, 1981).

cording to Calabro, 1986, 100-125mg daily diclofenac sodium delayed release tablets ministered as 25mg 4 times daily, with 5th dose at bedtime as needed is effective against kylosing spondylitis.

iclofenac Sodium tablets are well absorbed following oral administration (Riess*et al.*, 1978 and hn, 1979). They undergo first pass metabolism; only 50-60% of a dose reaches systemic rculation as unchanged drug (Novartis, 2006 and Willis *et al.*, 1979).

eak plasma concentration is usually attained within about 2 hours (Todd &Sorkin,1988). Food elays time to reach peak plasma concentration but does not affect extent of absorption as onventional delayed release tablets(Novartis, 2006).

iclofenac sodium is widely distributed in animals. According to Benson, 1985, following oral dministration, concentrations in synovial fluid may exceed those in plasma. Greater than 99% f Diclofenac sodium is bound to plasma proteins (John, 1979).

The absorbed drug is metabolized in the liver via hydroxylation and conjugation. Then it is liminated in urine (65%) and in feces via biliary elimination (35%)as metabolites (Todd &Sorkin,1988).

A study conducted by Zhang, *et al*, (2011), showed that H_2S released from S-diclofenac *in vivo* contributes to the protective effect in doxorubicin-induced cardiomyopathy. The data also provided evidence for a critical role of H_2S in the pathogenesis of doxorubicin-induced cardiomyopathy.

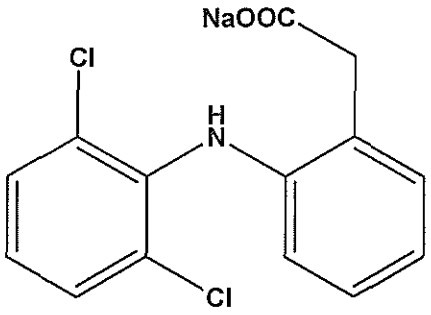
When diclofenac sodium is co-administered with voriconazole (inhibitor of CYP2C9, 2C19 and 3A4 enzyme), the Cmax and AUC of diclofenac increased by 114% and 78%, respectively (Novartis, 2011)

Diclofenac sodium enteric-coated tablets are contraindicated in patients withknown hypersensitivity to diclofenac and should not be given to patients who have experienced asthma, urticaria, or otherallergic-type reactions after taking aspirin or other NSAIDs. Severe, rarely

atal,anaphylactic-like reactions to NSAIDs have been reported in such patients. It must be ıvoided in the treatment of perioperative pain in the setting ofcoronary artery bypass graft ;urgery (Novartis, 2011).

2.3 Identification and assay of diclofenac sodium tablets (BP, 2009)

Diclofenac sodium is a white or slightly yellowish, slightly hygroscopic, crystalline powder that s sparingly soluble in water, freely soluble in methanol, soluble in ethanol (96 per cent), slightlysoluble in acetone and has a melting point of about 280^0C with decomposition. According o British Pharmacopoeia, diclofenac sodium can be identified one method; infrared absorption spectrum (BP, 2009).



sodium 2-(2-((2,6-dichlorophenyl)amino)phenyl)acetate

(Mwt-318.1g)

Figure 1: Structure of Diclofenac Sodium

During the manufacturing process of Diclofenac, Diclofenac sodium powdertends to contain ;ome related substances as specific impurities apart from non-specific impurities. The kind and ımount of specified impurities are considered as important factors for assessing quality of Diclofenac sodium tablets.

The above impurities are detected and determined using liquid chromatography and for each impurity, not more than the area of principal peak in chromatogram obtained with reference solution.

The content of diclofenac sodium in tablets is 95% to 105% of stated amount(BP, 2009)

According to BP, 2009, Diclofenac sodium is assayed by using liquid chromatography. However due to unavailability of liquid chromatography I had to opt for other methods of assaying Diclofenac sodium whose results are within the official limits.

A study on improvement of methods for the determination of Diclofenac sodium in pharmaceutical preparations in Pakistan found that the percentage purity of analyzed Diclofenac sodium tablets by UV/Visible spectrophotometer where within the official limits of 95% to 105% and reproducible (Hassan*et al.*, 2007-2010). The following results were obtained as shown in the table below.

Table 1: Percentage recovery of diclofenac sodium by spectroscopic method

Sample Tablet	Reference Absorption	Sample Absorption	% Purity
Artifen	0.361	0.368	101.9
Doloflam	0.361	0.360	99.72
Dyclo	0.361	0.356	98.61

The following are some of other tests employed in the analysis of drugs and their contents.

2.3.1 Hardness test

Hardness can be defined as the strength of the tablet to withstand the pressure applied. Analysis of the fracture resistance of tablets involves the application of a load on the tabletand the determination of the force needed to fracture or break the specimen along its diameter.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. 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(May *et al.*, 2013).

CHAPTER THREE: MATERIALS AND METHOD

3.1 Study design

This study was experimental.

3.2 Area of study

This research was carried out at KIU-WC, located in Ishaka town Bushenyi district in Uganda.

3.3 Determination of sample size

A total of 100 tablets of each brand were used for the study.

3.4 Selection criteria

3.4.1 Inclusion criteria

Only enteric coated tablets ofDiclofenac Sodium 50mg within the shelf life were used in the study. Diclo – Denk 50mg was used as a standard in assay of diclofenac sodium using UV-Vis Spectroscopic method. The selected brands shall be from the NDA approved list of drugs.

3.4.2 Exclusion criteria

The tablets containing DiclofenacSodium in combination with other active substances.

3.5 Laboratory analysis

The Diclofenac Sodium tablets will be bought from MM-Trust Pharmacy in Ishaka town, Bushenyi District. A given number of tablets were randomly selected from each of the three brands of Diclofenac Sodium for the specific test to be performed on them.

3.5.1 Weight variation test

Twenty (20) tablets were randomly selected from each branch of the Diclofenac Sodium tablets. The tablets were weighed individually using an electronic balance and the main individual weights recorded. The mean weight and relative standard deviation were calculated and recorded B.P, 2009).

3.5.2 Disintegration time test

The disintegration apparatus (BJ-I disintegration tester)wasused to carry out this test. Six tablets of each brand wererandomly selected and each tablet was placed in each of the cylindrical tubes of the basket-rack assembly of the disintegration time tester.The assembly was allowed to move up and down in a beaker containing 900mls of 0.1N HCl at 37±2°C simulated fluid at 28-32 cycles/minute for 2 hrs. Then HCl was replaced with 900mls of prewarmed phosphate buffer pH 6.8 and the disintegration was resumed for 1hr.The time taken for each tablet to disintegrate was recorded and the mean and standard deviation was calculated. The disintegration time is the time taken where no particles of the tablet remains on the basket assembly of the apparatus (Usman*et al.*, 2011).

3.5.3 Hardness test

YD-I tablet hardness tester was used to carry out this test. Ten tablets from each brand were randomly selected and each tablet was placed between the jaws of the hardness tester. The force was applied by adjusting the knob of the tester until the tablet integrity fails. The results were recorded in Newtons (N). The mean and standard deviation was also calculated and recorded.

3.5.4 Assay of Diclofenac Sodium by UV/Visible Spectrophotometric method

Preparation of Standard Stock Solution

20 tablets of Diclo-Denk 50mg were weighed. The weight in milligrams obtained was divided by20 to obtain weight equivalent to approximately 50mg. The 20 tablets were then powdered and the weight equivalent to approximately 50mg was dissolved in 100ml volumetric flask with distilled water. The suspension was sonicated for 5minutes to completely dissolve the remaining drug in powder. The suspension was filtered with Whattman filter paper and 20ml of the filtered solution was pipetted to make the volume 100ml with distilled water. The strength of the resultant solution was approximately 100µg/ml.The above solution was diluted by obtaining 5ml, 10ml, 15ml, 20ml, 25ml, and 30ml and dissolving them in 6 different 100ml volumetric flasks with distilled water. The strength of the resultant solutions was approximately 5µg/ml, 10µg/ml, 15µg/ml, 20µg/ml, 25µg/ml, and 30µg/ml respectively. The wavelength was selected by scanning the 20µg/ml solution in the 200-400 nm UV region. The wavelength maximum (λmax)

was observed at 278 nm and this wavelength was adopted for absorbance measurement.Absorbance of the other solutions was measured against distilled water at 278nm. The results obtained were recorded and used to plot a calibration curve of absorbance against concentration (µg/ml).

Preparation of Sample solutions

20 tablets of each brand were weighed separately. The weight in milligrams obtained for each brand was divided by 20 in order to obtain weight equivalent to approximately 50mg. The 20 tablets of each brand were then powdered and an equivalent weight of approximately 50mg was weighed and dissolved in 100ml volumetric flask with distilled water. The suspension was sonicated for 5minutes to completely dissolve the remaining drug in powder. The suspension was filtered with Whattman filter paper and 20ml of the filtered solution was pipetted to make the volume 100ml with distilled water. The strength of the resultant solution was approximately 100µg/ml.

20ml was pipetted from 100µg/ml solution to make volume in 100ml volumetric flask with distilled water. The strength of the resultant solutionswasapproximately 20µg/ml. The absorbance of 20µg/ml of sample stock solution of each brand was obtained against 20µg/ml of standard stock solution at 278nm. The procedure of obtaining 20ml from 100µg/ml solution was repeated three times to obtain three (3) values for each sample of each brand. The results were recorded.

3.6 Data analysis

Quantitative data was analyzed according to qualitative statistic using Microsoft Excel Version 2010 and the obtained results presented in tables and graphs.

3.7 Ethical considerations

The different brands of Diclofenac sodium tablets selected werecoded throughout the study process.

nformation from the analysis was kept confidential.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Weight Variation Test

Weight variation test of Diclofenac Sodium tablets proved statistically that all the tablets were in accordance to the BP requirements.

Table 2: Weight of 20 tablets (randomly selected) of different brands.

No. of Tablet	D1	D2	D3
1	0.143	0.153	0.122
2	0.135	0.163	0.134
3	0.134	0.16	0.136
4	0.126	0.159	0.126
5	0.141	0.163	0.131
6	0.13	0.156	0.124
7	0.134	0.163	0.13
8	0.139	0.161	0.135
9	0.128	0.158	0.125
10	0.131	0.155	0.133
11	0.124	0.157	0.134
12	0.125	0.161	0.137
13	0.13	0.163	0.129
14	0.13	0.156	0.131
15	0.135	0.16	0.123
16	0.127	0.16	0.129
17	0.136	0.155	0.121
18	0.14	0.161	0.13
19	0.133	0.161	0.119
20	0.13	0.157	0.129

Table 3: Statistical Weight Variations

Brand	Average (gm.)	Standard deviation	Upper limit (X+3S)	Lower limit (X-3S)
D1	0.13255	0.005424	0.148822	0.116278
D2	0.15910	0.003059	0.168277	0.149923
D3	0.12890	0.005251	0.144652	0.113148

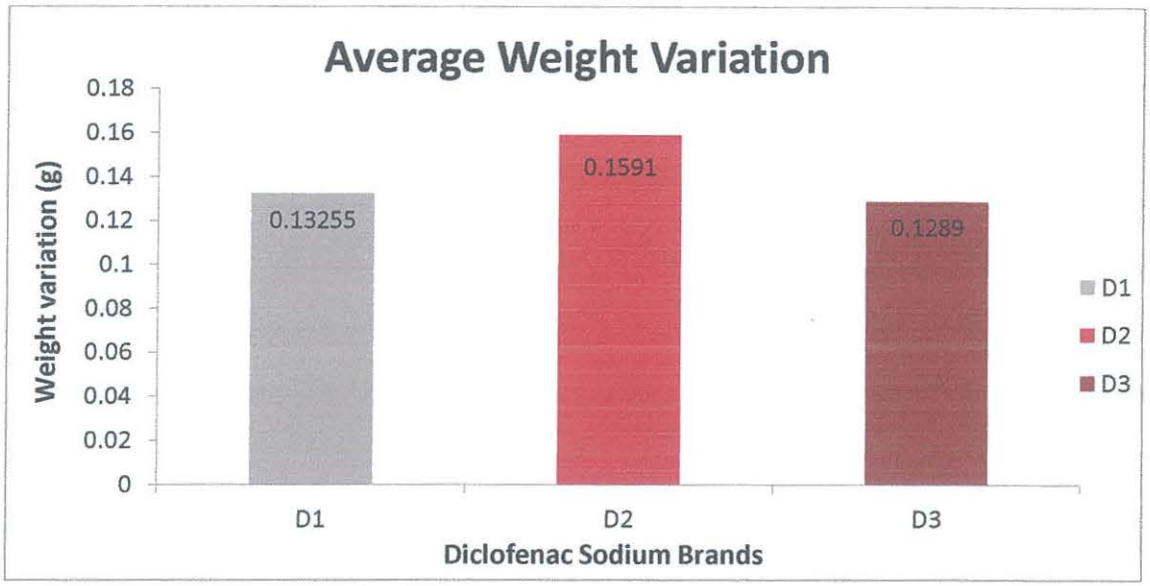


Figure 5: Average Weight Variation of diclofenac sodium brands

Table 4: Weight Variation test

Brand	Result (gm.)	% Weight Variation	BP Specification	Deviation from BP specification
D1	0.13255	4.09195	Deviation should be ±7.5%	All within specified limit
D2	0.15910	1.92273		
D3	0.12890	4.07336		

Diclofenac sodium tablets used in this study showed weight variations as shown in **Table 2** and where all within the upper and lower limits as shown in **Table 3**. Weight variations exist because various brands are produced by different companies which use different excipients. The variations in the weights have to be optimized to improve on tablet strength and integrity and the percentage variation within ± 7.5% deviation (BP, 2009). Recent studies have shown that oral solid drugs of uniform size and weight are easily acceptable by the public for consumption, thus showing the interest by pharmaceutical industries to optimize weights and shapes to increase on profits (Ranjith & Mahalaxmi, 2015). However, the major additives have been shown to influence drug physicochemical properties which would affect the recommended ± 7.5% weight

variation deviation (Colombo *et al.*, 1983), showing a need to consider findings from this study seriously.

4.2 Hardness Test

From **table 5** it is clear that the hardness of all tablets is in the range of 427.44 ± 14.93833 to 529.12 ± 94.04021 but variations exist among the tablets.

Table 5: Hardness (N) of Tablets from each brand

No. of Tablet	D1	D2	D3
1	449.3	808.2	784.9
2	427.9	827.9	633.7
3	448.3	825.5	650.6
4	407.2	797.5	444.3
5	434.4	743.2	665.2
6	430.2	747.2	720.8
7	412.8	757.4	546.7
8	431.2	791.6	662.8
9	425.6	792.3	600
10	407.5	751.7	582.2

Table 6: Statistical Hardness

Brand	Average (N)	Standard deviation	Upper limit (X+3S)	Lower limit (X-3S)
D1	427.44	14.93833	472.255	382.625
D2	784.25	32.16814	880.7544	687.7456
D3	629.12	94.04021	911.2406	346.9994

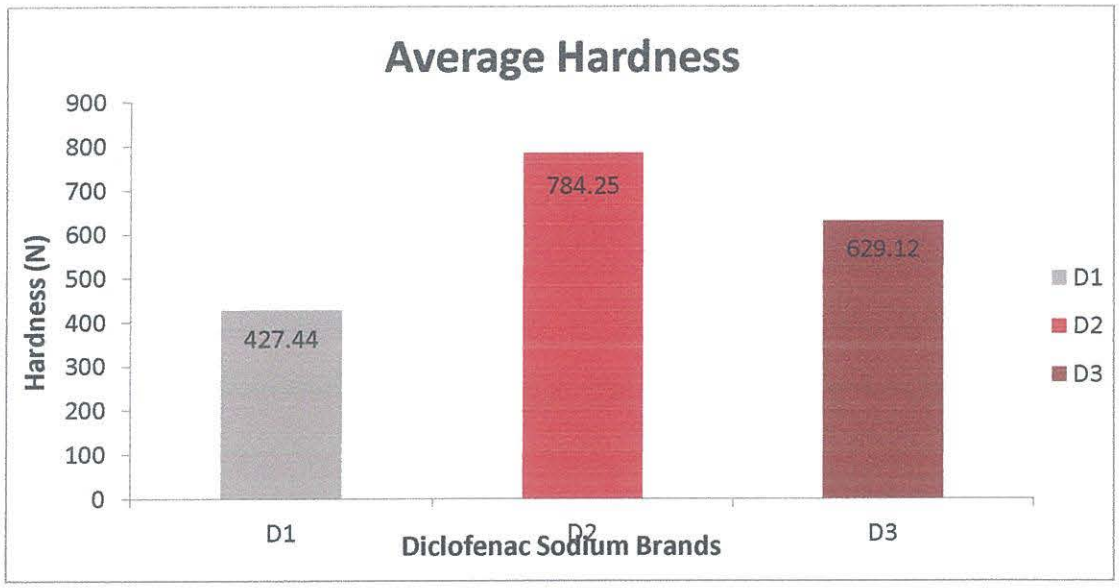


Figure 6: Average hardness (N) of 10 tablets

The hardness test results showed that brands D2 and D3 exhibited greater capability to resist breaking than D1. Brand D1 demonstrated the lowest and weakest solidity compared to other brands. In general, tablets should be sufficient hardness to withstand stress of handling, packaging, and shipping. However, if the hardness exceeds a certain limit, it increases the disintegration time, which ultimately affects the bioavailability (Lachman *et al.*, 1976).

4.3 Disintegration time test

The results of the disintegration time test showed that brands D1 and D2 passed the test according to the official limits **(Table 7).** While brand D3 failed to pass in acidic medium.

Table 7: Disintegration time of Diclofenac Sodium Brands (Mean Value ± SD)

Brand	HCl (hr:min:sec.)	phosphate buffer pH 6.8 (hr:min:sec)
D1	No disintegration after 120 min.	00:11:11 ± 0.001
D2	No disintegration after 120 min.	00:10:46 ± 0.002
D3	00:38:07 ± 0.028515	00:07:33 ± 0.001

The results of disintegration time test showed that brands D1 and D2 passed according to BP limits **(Table 7)**. While brand D3 exhibited cracking in acidic medium and showed a fast disintegration in alkaline medium. The BP limit states that tablets should remain intact for 120

minutes in acidic medium and then disintegrate during one hour in an alkaline medium (BP, 2009). It was observed from the disintegration data that brands D1 and D2 demonstrated optimum stability in the acidic medium, as the tablets remained intact and did not show any cracking or softening. Although brand D3 had a moderate hardness compared to other brands, it showed disintegration time that was outside the limits for enteric coated tablets. It has been proven that coating characteristics control the acidic resistance capability of the tablets (Niwa*et al.*, 2014).

4.4 Quantitative Assay of Diclofenac Sodium

Data for calibration curve ofstandard diclofenac sodium was obtained as shown in **Table 8**. A calibration curve for Standard Diclofenac Sodium was constructed by plotting the absorbance versus concentration as shown in **Figure 7**.Conformity to Beer - Lambert's Law was evident over the concentration range of (5.00-30.00µg/ml) **Figure 7**, with the meancorrelation coefficient of **0.9997** and an intercept of **0.0023**.The quantification of the brands of Diclofenac sodium was based on the calibrated curve constructed. The method of linear regression was used for the calculation and the linear regression equation for standard diclofenac sodium was: **$y = 0.031 x + 0.0023$ (R^2=0.9997).**

Table 8: Data for calibration curve of standard diclofenac sodium

Sr. No.	Concentration(µg/ml)	Abs at 278nm
1	5.003	0.152
2	10.01	0.317
3	15.01	0.478
4	20.01	0.616
5	25.02	0.779
6	30.02	0.929

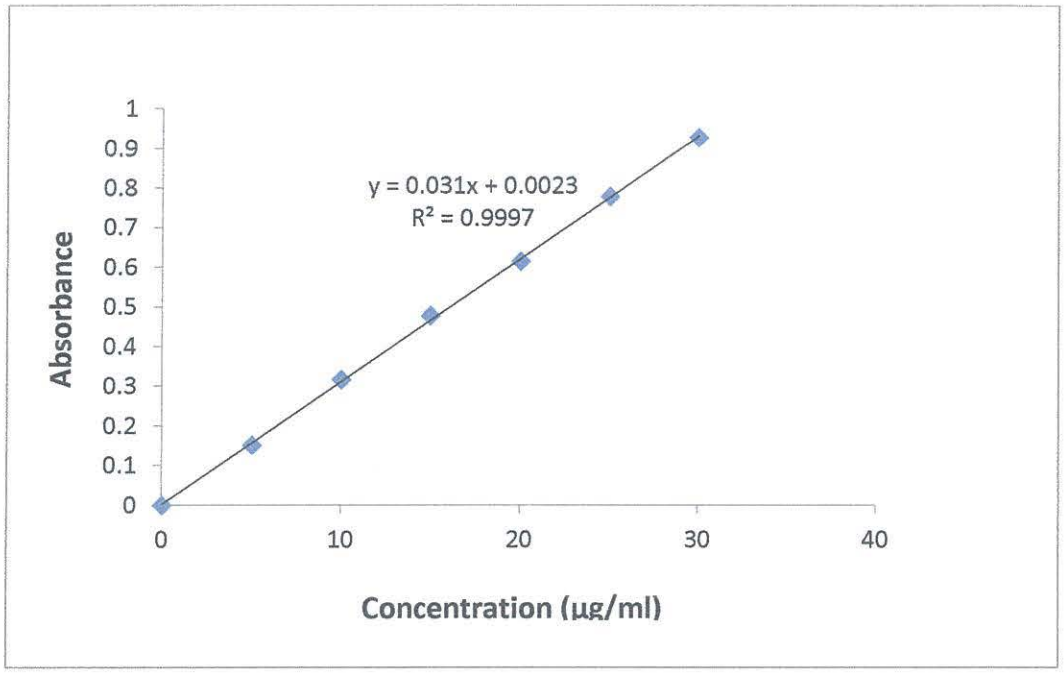


Figure 7: Calibration curve of Standard Diclofenac Sodium

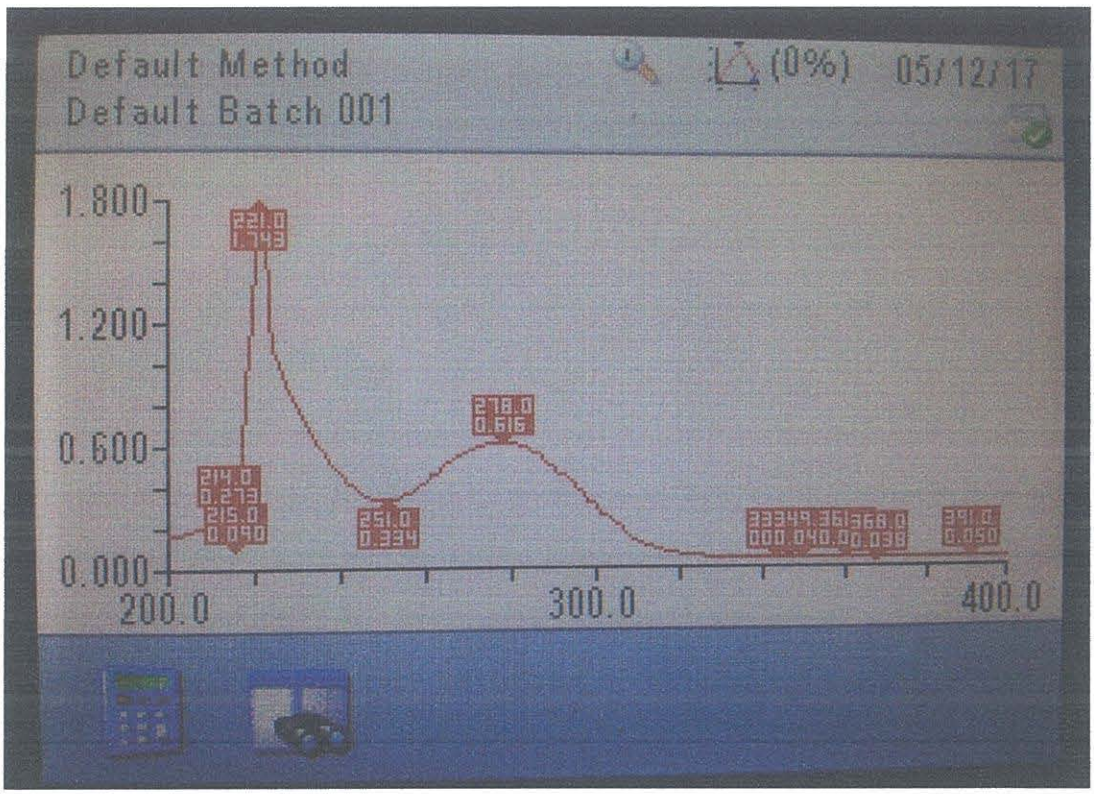


Figure 8: Absorbance vs. Wavelength of Standard diclofenac sodium

Results of percentage stated content shows that all three brands of diclofenac sodium failed the test as shown in **Table 9.**

Table 9: Percentage stated content of Diclofenac Sodium brands

Brand	Calculated weight(g)	Actual weight(g)	Nominal concentration (µg/ml)	Calculated Concentration(µg /ml)	Percentage stated content (%)	Remarks (BP 2009)
D1	0.134865	0.1349	20	20.004	75.8	Failed
D2	0.160715	0.1606	20	19.986	89.1	Failed
D3	0.132725	0.1326	20	19.981	82.1	Failed

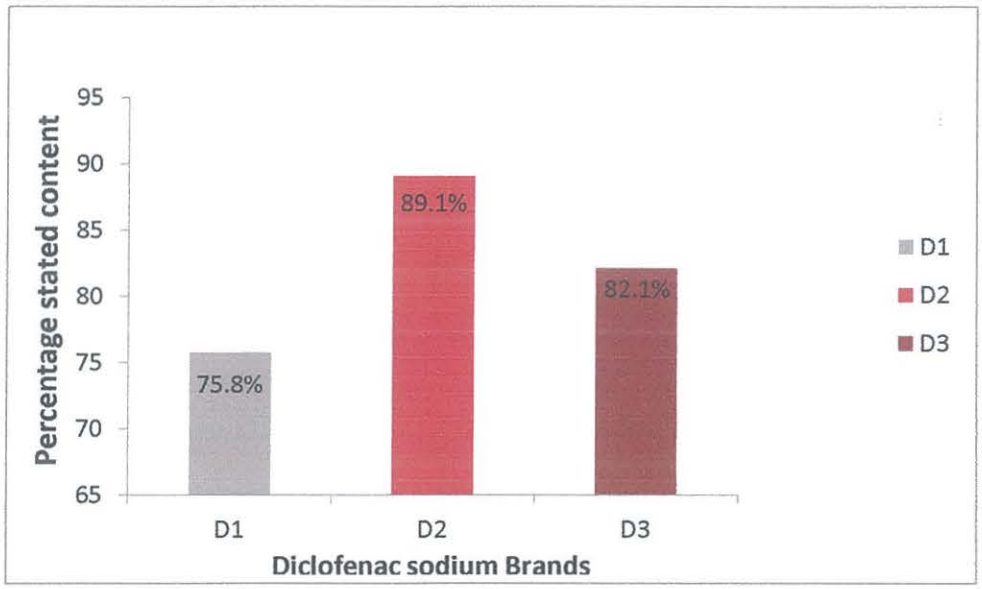


Figure 9: Percentage stated content of Diclofenac sodium brands

Using UV-Vis spectrophotomer, pharmaceutical assay was carried out on all the three brands of Diclofenac sodium. The limit of pharmaceutical assay according to the specification of BP is **95-105%**. From **Table 9** it's clear that the quantitative assay of all the three brands failed. Brand D1 had the least percentage stated content **(75.8%)** followed by brand D3 **(82.1%)** and then brand D2 **(89.1%)** as shown in **Figure 8**. This was due to use of a low sonication time of 5 minutes to extract the API from the drug. A study by Safila and Fatima (2014) on the UV spectrophotometric assay of Diclofenac sodium brands available revealed that sample powder

equivalent to **10mg** of diclofenac sodium was transferred into a volumetric flask containing 10ml water and the solutions were sonicated for about **5 minutes**. The results showed that the brands used were within BP range. This suggests that the sonication time (5 minutes) used herein was too low to extract powdered samples equivalent to **50mg**. Therefore validation of sonication time was supposed to be done by constructing a graph of absorbance against sonication time to obtain the optimum time for extracting the API from the drug.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Within limitations of this study, brand D3 failed the disintegration time test. All diclofenac sodium brands failed the assay test because of using a low sonication time for extracting the API from the drug.

5.2 RECOMMENDATIONS

Further tests should be carried out to validate the sonication time against absorbance to obtain an optimum time for extracting the API from the drug using water as a medium.

Fully equipped laboratory with UV-Vis spectrophotometry of wavelength range 200-400nm at KIU-WC for further reference.

NDA or other research groups should conduct further studies to evaluate the quality of diclofenac sodium tablet in terms of disintegration time test, spectrophotometric assay, and microbiological quality of tablets.

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