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QUALITY CONTROL AND INTERCHANGEABILITY OF DIFFERENT BRANDS OF OLANAZAPINE 10MG TABLETS: COST IMPLICATION IN NIGERIA

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ABSTRACT

The use of branded products and their cost implications are source of concerns in the developing countries. The study was done to evaluate nine different brands of Olanzapine 10 mg tablets which are commercially available in the Nigerian Market. The study aimed to compare the cost to benefit ratio of generic brands using both Pharmacopeia and non-pharmacopeia test methods and infer on their interchange ability with the innovator brand. The tablets were subjected to thickness, diameter, weight uniformity, drug content, friability and disintegration tests, which all the samples passed. Only samples AAO, BTO and CTO passed the hardness test with each having a hardness of 4kg/m^2. The *in-vitro* release studies were quantitatively determined using UV spectroscopy method and their release pattern evaluated using Model-independent methods (Fit factors and dissolution efficiency).The release patterns of the evaluated samples showed only brands BTO, DEO, FCO and GNO had similarity of above 50% when compared to the innovator brand (IZO), the values for difference factor were within the range 0 and 15 except for brand EAO, indicating slight differences from the innovator brand. The dissolution efficiencies when compared to the innovator brand showed that only brands BTO, DEO and FCO were within the acceptable limits of ±10%. This study concluded that the brands of olanzapine studied passed most of the conducted tests, including the content of active ingredient tests. However, based on their dissolution efficiencies and other tests, only brands BTO (Teva-Olanzapine™) and FCO (Excelpin™) showed enough similarity with the innovator product (Zyprexa™) and can therefore be interchanged with minimal cost-implications in clinical settings.

INTRODUCTION

Generic brands remain a sought-after alternative in health care delivery, especially in low- and middle-income countries as there generally exist a problem of accessibility and affordability of innovator brands, as most of these brands cost more than an average consumer can afford. This creates a huge gap and limitation in the delivery of health care and health care services in these countries, hence a need for the switch and replacement of expensive and unaffordable brands with generic brands, since they provide a lower cost and can help make great savings in the health care sector. (Gamil and Othman, 2014)

The switch or replacement of innovator brand for generics rely on the premise that generic versions of originator products are bioequivalent and interchangeable. This however continues to be debated despite 98% of some 2070 bioequivalence studies submitted to the FDA (US Food and Drug Administration) showing variations of less than 10% of that of their comparator originator brands (Davit *et al.*, 2009).

While there has been an increased adoption of generic products in Low- and middle-income countries, the lack of sufficient evidence and potent regulatory systems remain top problems for the full adoption of generic products in health-care service delivery. This insufficiency not only affects the ability and decision of health care professionals and prescribers in the choice of medication, but also affects the trust of the consumer in making informed choices on brands to use.

A report made in 2016 by Warren K. *et al.*, show certain requirements needed for the adoption of generic medication use in low- and middle-income countries. One of the requirements is a mechanism sufficient to provide certainty and confidence that generic medicines are of assured quality, which involves having an effective regulatory system. (Warren *et al.*, 2016).

Generic products ought to meet up certain qualitative and quantitative criteria to be considered bioequivalent to their innovator brands. These largely form the basis and sufficient evidence for the adoption of generics.

Olanzapine is a second-generation antipsychotic used in the treatment and management of Schizophrenia and other related mental conditions. It is one of the most recent antipsychotics that show least side effects, and is often the drug of choice in the long-term management of schizophrenia.

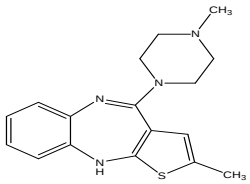

Fig. 1.0: Structure of Olanzapine.

The study was done to evaluate multi-sourced generic brands of Olanzapine 10mg tablets marketed in Nigeria. The study aimed to compare the cost to benefit ratio of generic brands using both pharmacopeia and non-pharmacopeia test methods and infer on their interchangeability with the innovator brand.

MATERIALS AND METHODS

Materials

Pure samples of Olanzapine obtained from AK scientific, India. Generic brands of Olanzapine 10 mg tablets as shown in table 1.0. Monsanto hardness tester, Analytical weighing balance, Disintegrating machine, Dissolution machine USP apparatus 2 (DT60 dissolution tester, Erweka, Heusenstamm, Germany)., pH meter, UV Spectrophotometer, Pure samples of Olanzapine, Glassware, Friabilator.

Table 1.0: Physical Properties of nine (9) brands of Olanzapine tablets evaluated.

Brand Code	Brand Name	Manufacturer	Inscription	Batch No	Expiry Date	Price/10-mg tablet (₦)	NRN	Country of origin
AAO	Olanza®	Aurochem Labs (I) PVT	OL/10	(10) F0018	05/2023	60.71	A4-4256	India
BTO	Teva Olanzapine®	Teva UK limited	OL/10	0C05OS	03/2022	100.00	-	UK
CIO	Ozane®	Incepta Pharmaceuticals Ltd	-	19004	03/2022	85.00	-	Bangladesh
DEO	Excelpin®	HAB Pharmaceuticals and Research limited	-	1056-01	03/2022	60.00	B4-9497	India
EAO	Almay Olanzapine®	Sydler Remedies Pvt. Ltd	-	FOP1901	01/2022	30.00	B4-7850	India
FCO	Ciron Olanzapine®	Ciron Drugs and Pharmaceuticals Limited	-	9E02283	05/2022	30.00	B4-7395	India
GNO	Naman Olanzapine®	Naman Pharma drugs	-	OLZ-09	06/2023	30.00		India
HQO	Olapleza®	West-coast Pharmaceutical Works Ltd	-	WG19459	11/2023	30.00	A4-7982	India
IZO	Zyprexa®	Lilly S. A	Lilly 4117	D335966	05/2023	2500.00	04-4192	Spain

The label strength of each sample of the tablets is 10 mg.

Methods

- Weight Uniformity Test

Weight uniformity test was performed on the different brands of olanzapine by weighing 20 randomly selected tablets from the samples using an analytical weighing balance. The average weight of the tablets was then determined and compared to the individual weights to obtain the percentage deviation.

- Hardness Test

Ten (10) tablets each from the evaluated brands were tested for hardness using a Monsanto hardness tester. The crushing strength in kg/m2 for each tablet was obtained and recorded. The obtained values were then compared against standard values.

- Friability Test

Friability test was carried out by initially dusting ten (10) tablets from each brand before being subjected to a uniform tumbling motion for a period of 4minutes at 25revs/min in a friabilator. They were then de-dusted and reweighed. From the results obtained, weight lost was calculated and expressed in percentage.

- Thickness and Diameter Test

The thickness and diameter of the brands of olanzapine were each obtained by measuring the thickness and diameter of 10 tablets from each brand using a micrometer screw-gauge. The values obtained in mm were recorded and used to compare against standard values.

- Beer's Plot and Calibration of Curve

A 10 mg of the pure sample of olanzapine was completely dissolved in 100 ml of 0.1N HCl maintained at a pH of 1 to get a stock solution with a concentration of 100 µg/ml. From the stock solution, aliquot of 0.2, 0.4, 0.6, 0.8, 1.0, 1.2 and 1.4 ml were measured respectively using a pipette and transferred to previously rinsed 10 ml volumetric flasks. They were made up to 10

ml to obtain concentrations of between 2µg/ml and 14 µg/ml. The spectrum was then recorded between 400 – 200 nm and the optimum wavelength of 262 nm selected.

The samples were then analyzed using a UV spectrophotometer at a set wavelength of 262 nm. The values gotten were then used to determine the Beer's plot.

- Content of Active ingredient test

Ten (10) tablets for each sample were randomly selected, weighed using an analytical weighing balance and their average weight equivalent to the weight of one tablet calculated. The tablets were then crushed in a mortar using pestle until a smooth powder was gotten. The average weight which is equivalent to the average theoretical content (10 mg) of each tablet was then weighed out from the crushed sample. The weighed sample was dissolved in 100 ml of 0.1N HCl acid to get a stock solution with a concentration of 100 µg/ml. From the stock solution, 0.2 ml was withdrawn and transferred to a 10 ml volumetric flask, which was made up to 10 ml using 0.1N HCl acid.

The diluted samples for each batch were then analyzed using a UV spectrophotometer at 262 nm. The obtained values were then used to calculate the actual content of active ingredient and inferences made.

- Disintegration Test

One tablet was each placed each of the six tubes, and a disc was placed to act as a stopper. The apparatus was then operated using 0.1N HCl as the immersion fluid and maintained at 37°C. The time taken for each tablet to completely disintegrate was recorded and inferences made.

- Dissolution Test

The dissolution rate tests were carried out on the different brands of Olanzapine tablets using USP apparatus 2 (DT60 dissolution tester, Erweka, Heusenstamm, Germany). A 900 ml volume of 0.1N HCl acid maintained at a temperature of 37 ± 0.5°C was used. The rotation speed of the paddles was set at 50 rpm. 5 ml volumes of the samples were withdrawn at 5, 10, 15, 20, 25, 30, 40, 50 and 60 minutes by a an already calibrated pipette. After withdrawal of the sample, fresh dissolution medium was simultaneously replaced in the vessel to maintain a constant dissolution volume. From the 5 ml collected, 2 ml was transferred to a 10 ml volumetric flask and made up to mark. The diluted samples were then analyzed using a UV spectroscopy at a wavelength of 262nm.

The results obtained were used to compare the dissolution profiles of the different brands of Olanzapine based on their release at different points. Model-independent model were also employed for this comparison. The methods used include: Similarity factor (*f2*), Difference factor (*f1*) and Dissolution efficiency (DE%).

RESULTS

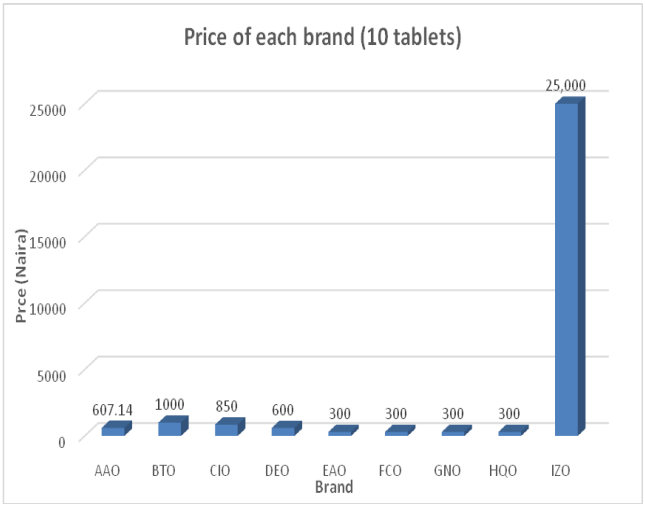

Fig. 2.0: Prices of different brands of Olanzapine (n = 10 tablets).

Table 2.0: Physiochemical parameters of different brands of Olanzapine tablets Assayed.

All the tablets were round in shape

Brand Code	Colour	Diameter (mm) ± SD n = 10	Thickness (mm) ± SD n = 10	Weight Variation (mg) ± SD n = 20	Hardness (kg/m^2)± SD n = 10	Friability (%) n = 10	Mean Disintegration time (min) ± SD n = 10	Assay (%)
AAO	Peach	10.96 ± 0.03	4.51 ± 0.05	357.10± 0.3	4.45 ± 0.3	0.03	2.28 ±1.83	103.08
BTO	White	8.93 ± 0.03	4.77 ± 0.06	210.25 ± 2.2	3.95 ± 0.3	0.24	3.24 ± 2.48	92.31
CIO	Grey	9.86 ± 0.04	4.70 ± 0.04	271.00 ± 3.5	3.90 ± 0.3	0.04	0.77 ± 0.50	113.08

DEO	Yellow	8.12 ± 0.04	3.13 ± 0.04	182.60 ± 2.8	3.05 ± 0.3	0.06	4.16 ± 1.22	96.15
EAO	Orange	8.89 ± 0.05	3.43 ± 0.02	199.05 ± 5.4	2.45 ± 0.2	0.20	4.58 ± 1.44	103.85
FCO	Yellow	6.61 ± 0.03	3.04 ± 0.03	121.70 ± 2.6	1.80 ± 0.3	0.08	0.83 ± 0.58	91.54
GNO	Yellow	8.89 ± 0.03	4.65 ± 0.04	232.80 ± 10.7	3.25 ± 0.8	0.04	8.62 ± 1.31	91.54
HQO	Orange	7.12 ± 0.03	3.29 ± 0.05	162.70 ± 3.0	2.83 ± 0.3	0.18	2.40 ± 2.02	93.08
IZO	White	10.03± 0.02	5.86 ± 0.03	422.50 ± 3.0	1 0.55 ± 0.4	0.03	10.85 ± 1.54	100.77

In the present study, sample quantification was based on the previously constructed calibration curve. The calibration curve has correlation coefficient (r) and linear equation of 0.9966 and Y = 0.065x respectively. It is linear in the ranges of 2.0 – 14.0 mg/ml.

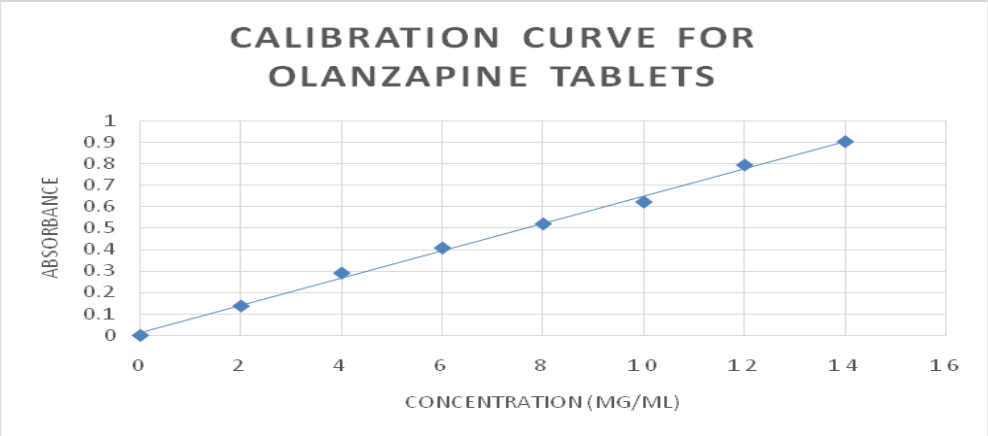

Fig. 3.0: Calibration curve for Olanzapine tablets for the determination of the actual amount of active content.

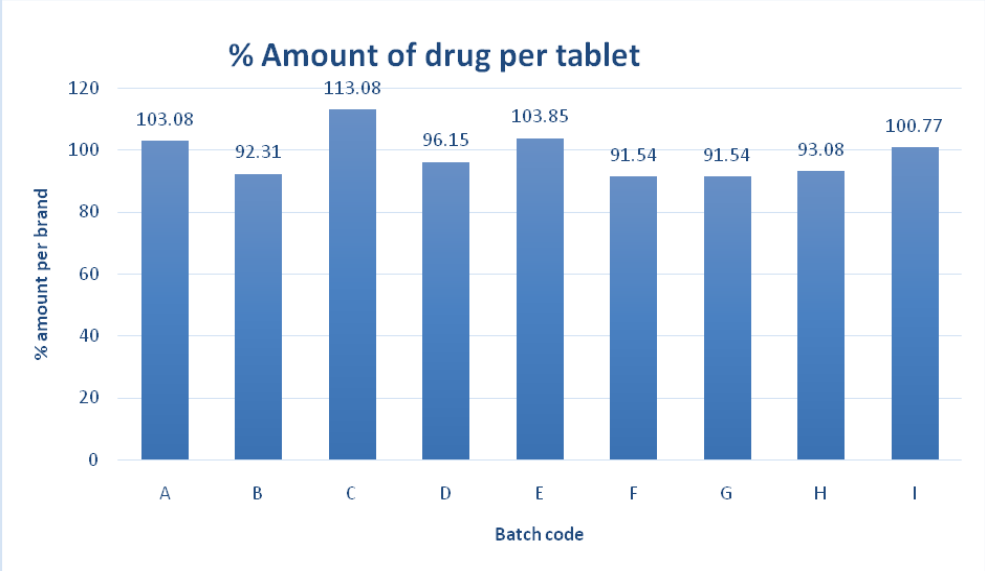

Fig. 4.0: Content of Active Ingredient of different brands of Olanzapine tablets.

Table 3.0: Dissolution profiles of different brands of Olanzapine tablets.

Time (min)	AAO	BTO	CIO	DEO	EAO	FCO	GNO	HOO	IZO
0	**0**	0	0	0	0	0	0	0	0
5	25.61	28.27	16.16	22.93	13.69	27.19	33.29	13.63	19.14
10	60.58	66.53	45.77	51.99	47.91	64.92	62.15	31.63	72.53
15	68.45	80.82	73.38	83.08	82.63	68.26	83.23	55.07	74.54
20	76.33	87.97	78.76	86.66	83.75	80.18	89.90	70.34	77.55
25	95.30	89.00	82.13	87.93	85.56	85.12	90.45	80.70	79.07
30	98.99	89.00	82.58	89.69	88.98	89.62	89.34	86.16	79.58
40	98.99	91.25	83.03	90.48	93.38	93.50	90.45	87.25	80.58
50	101.44	96.72	83.48	94.30	91.23	98.20	91.56	90.52	94.66
60	100.46	99.53	85.72	101.25	86.04	101.78	93.56	102.51	101.00

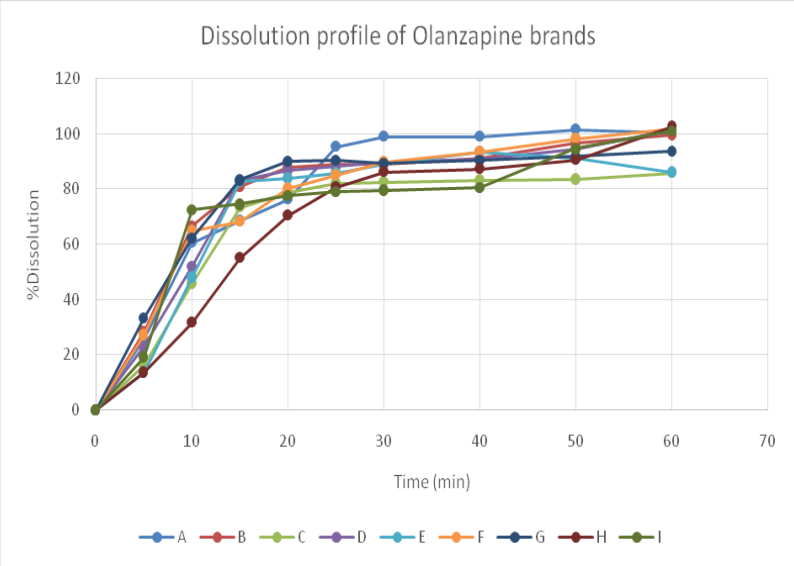

Fig. 5.0: Release profile of nine different brands of Olanzapine tablets.

Table 4.0: Dissimilarity factor (*f1*) and similarity factor (*f2*) of nine different brands of Olanzapine tablets.

Pair comparison	Difference factor (*f1*)	Similarity factor (*f2*)
AAO vs IZO	7.0	46
BTO vs IZO	7.4	55
CIO vs IZO	7.0	48
DEO vs IZO	4.4	50
EAO vs IZO	0.8	46
FCO vs IZO	4.4	57
GNO vs IZO	6.7	50
HOO vs IZO	9.0	40

Table 5.0: Dissolution Efficiencies (%DE) of nine different brands of Olanzapine tablets.

Brand code	%DE	*Difference of %DF*
AAO vs IZO	81.0	7.3
BTO vs IZO	80.5	6.8
CIO vs IZO	81.5	7.8
DEO vs IZO	77.2	3.5
EAO vs IZO	87.4	13.7
FCO vs IZO	77.4	3.7
GNO vs IZO	84.7	11.0
HOO vs IZO	68.2	5.7
IZO	73.7	-

% DF = test product – reference product

DISCUSSION

Olanzapine a polymorphic antipsychotic drug which is highly lipophilic with high membrane permeability thus it belongs to class II in BCS classification. This work studies nine different brands of olanzapine randomly purchased from registered pharmacies in the southern part of Nigeria. Out of these nine different samples, samples AAO, DEO, EAO, FCO, GNO & HQO were manufactured in India (Table 3.1), samples BTO & CTO were manufactured in UK and Bangladesh respectively while sample IZO (innovator brand) was manufactured in Spain. This finding shows that the possibility of many drugs being sold in Nigeria have their origin in India. The shape, size and colour are all visual characteristics used to differentiate solid dosage forms. The physical characteristics like the size, shape and colour may affect patient acceptability and/or compliance of medication. Among other reasons, tablets are coloured for identification, flavours perception, brand identification, quality perception and counterfeiting prevention. (Paul, 2004) Samples DEO, FCO and GNO were yellow in colour, while samples EAO and HQO were orange in colour (Table 3.2). Samples IZO and BTO were whitish in colour and only sample CTO is grey. Within Europe the EC food legislation directive 95/45/EC was adopted as the official documentation detailing the permitted colouring material in pharmaceuticals. Shape of a drug can be a unique way to differentiate that particular brand from others or to establish recognizability and brand loyalty. Basically, there are two tablet shapes, round and

non-round. The "swallowability" of the tablet can be affected by the design and profile of the form being produced. (https://www.fda.gov/downloads/drugs/guidance). Six brands out of the samples under investigation were manufactured in India, but it is only one of them that has inscription on it (AAO) while the other two samples (BTO and IZO) were manufactured in United Kingdom and Spain respectively (Table 3.2). Meanwhile, the sample produced in Bangladesh has no inscription. The imprint code when used in conjunction with the product's size, shape and colour permit the identification of the drug product, the active ingredient(s), strength and the manufacturer or distributor/marketer of the product by law enforcement officials, healthcare providers and the patient or caregiver. There is a possibility of two different products having the same inscription as we have in this study. Brands AAO and BTO have the same inscription "OL/10". This coincidence is as a result of the fact that the two products were manufactured in different country. This study also points out something about regulation that make it mandatory to inscribe something on pharmaceutical products as we have in the US and Europe (FDA, 2019)

All the samples under consideration have embossed either on their packets or primary packaging material the manufacturing/expiry date, batch number and the strength of each unit dosage form (Table 3.1). One of the samples manufactured in India (GNO), Bangladesh (CTO) and the one from UK (BTO) were not registered with NAFDAC. This study strongly believes that either the marketing company of these brands were in the process of registering these products or they belong to the group called "parallel importation" product in Nigeria.

The thickness of a tablet is determined by the diameter of the die, the amount of fill permitted to enter the die of the fill material and the force or pressure applied during compression. Uniformity in thickness of a tablet batch is important as it serves as a criterion to guide product development and quality-control specification. It helps in the production and making of tablets that are identical in appearance. While thickness tests are not included as a pharmacopeia test, it is important as it evaluates the quality of tablet packaging. The thickness of a tablet depends on the size of the tablets and thus varies among different brands and products. It should be controlled within a limit of ±5% in a batch. From the results obtained in the conducted study, all batches passed the specification as the evaluated tablets were within the specified percentage limit. The diameter of a tablet is a standard pharmacopeia test done to evaluate the different diameters of tablets in a batch to ensure uniformity. Uniformity of diameters play a role in product appearance as well as consumer acceptance. According to USP standards, in tablets with diameters less than 12.50 mm, the deviation should not exceed ±5%; and for tablets above 12.50 mm, deviation should not exceed ±3%. From the results obtained in the study, all the samples passed the test (Table 3.2), as all evaluated tablets of the different batches fall within the specified percentage range.

The uniformity of weight test is a non-destructive test performed on solid dosage forms to ensure that each unit contains the specified amount of drug substance, with little variation within a batch. It is a valid indication of corresponding variation in drug content of individual tablets. Weight variation test is a function of granulation quality, flow properties of the granules, the type and the speed of the tableting machine. The most common cause of weight variation are difference in the bulk densities of the granules and the particle size distribution during compression. According to USP, tablets with average weight above 324 mg when weighed singly, should not have more than two of the tablets deviating from the average weight by a percentage greater than ±5% and none of the tablets should deviate by more than 10%. Tablets with average weights between 130 - 324 mg should not have more than two tablets deviating by a percentage greater than ±7.5% and none deviating by more than ± 15%. While for tablets weighing below 130 mg, the acceptable range is ± 10%. The result of this study (Table 3.2) showed that all the samples passed the test, as all weighed tablets were within the specified percentage limits.

Tablet hardness is an important bioequivalence and drug property monitor, it determines the resistance of the tablet to chipping, abrasion, or breakage during storage, transportation and handling before usage (Abbirami *et al*., 2013). Among the factors which affect the hardness of a tablets are compressional force applied when compressing the tablet, the amount of binder used during the granulation and granulation method adopted in preparing the tablet. The hardness of a tablet can affect the disintegration of the tablet, if a tablet is too hard, it may not disintegrate within the required time. And if it is not hard enough, it may break, chipped or laminate before the required time and would not be able to withstand external pressure and can get destroyed upon handling (Davinder, 2002). According to USP pharmacopeia standards, for a satisfactory tablet a minimum force of 4 kg/m^2 and a maximum force of 8 kg/m^2. The results obtained in this study (Table 3.2) showed that sample FCO had the least hardness value (1.80 kg/m^2) while sample IZO had the highest value (10.55 kg/m^2). Samples AAO (4 kg/m^2), BTO (4 kg/m^2) and CTO (4 kg/m^2) passed the test. The remaining samples, including the innovator product "IZO" failed the test. Though, samples AAO and IZO had similar parameters like the thickness, diameter and average tablet weight which contributed to tablet hardness, sample AAO passed the test while IZO failed the test, this can be accounted for by the tablet dimension and the average weight of the tablet. This may be due to concentration of binder used, the type and concentration of lubricant used, compressional force applied, and the

characteristic of the granules used in producing the tablet. This test gives an indication that sample IZO may be too hard, but hardness alone cannot be used to determine the suitability of the use of sample IZO, thus we look at it later in this discussion.

Friability test is a measure of resistance of tablets to abrasion or fracture. This test is performed to determine the ability of tablets to withstand abrasions and mechanical disturbances during packaging, handling and shipping. The test is rejected if any tablet caps, laminate or break up in course of the test. A number of factors are to be considered when evaluating the friability of a tablet, most importantly the moisture content. A low but acceptable moisture content could serve as a binder for tablets, as tablets with very dry granules tend to break easily when subjected to a friabilation when compared with those with little moisture content between 2-4% (Davinder *et al*, 2016). According to USP specifications for friability test, a percentage loss not greater than 1% after being subjected to a friabilation is permissible. All nine (9) brands of olanzapine passed the friability test (Table 3.2) and have met the specification of USP which specifies that any brand they must not lose more than 1% of their initial weight.

Disintegration testing measures the ability of a tablet to breakdown into smaller particles or granules to allow the active drug be absorbed into the body. The disintegration time was performed to evaluate the time required for a drug to disintegrate in the gastric environment. It also shows the drug release profile of the drugs. The disintegration test is an important *in-vitro* test which can be used to predict the *in-vivo* bioavailability of a drug. The bioavailability of a tablet form is closely associated with the preparation's disintegration time and dissolution rate. (Kitazawa *et al*, 1975). The disintegration and hardness tests share a link, as the harder a drug is, the longer the time it takes to disintegrate. The hardness test is however not used alone in accepting a batch of products, the disintegration test has to be done to support the claims. (Abbirami *et al*, 2013). According to USP 2013 specifications, the disintegration time requirement for tablets is less than 30 mins. From the results obtained (Table 3. 2), all the samples pass the test as their disintegration time was below the recommended values.

The content uniformity test was developed to ensure content of active drug substance is maintained within a narrow range around the labeled claim in dosage units. Unless otherwise stated in the USP monograph, the requirements for content uniformity are met if the amount of active ingredient in nine (9) of the ten (10) tablets lies within the range of 85% to 115% of the label claim of active ingredient and the standard deviation is less than 6%. There are factors which influence the uniformity of the content of active ingredients in each batch of tablets produced, they include: tablet weight variation, uneven distribution of the drug in the powder or granules and segregation of the powder mixture or granules during formulation processes. (Jan *et al*, 2014). The content uniformity ranges from 91% mg (FCO and GNO) to 113% (CTO). All nine (9) brands of olanzapine passed the content uniformity test and have met the specification of USP (Table 2) which specifies that any brand must be within 85% and 115% of the labeled claim.

The results obtained from the comparative *in vitro* dissolution study are summarized in Table 3.3 and the corresponding dissolution profiles of the tested generic vs the reference product is presented graphically in Fig. 3.3. The dissolution test was further evaluated using Model-independent methods, Similarity factor, Difference factor and Dissolution efficiency to check for the patterns of release, comparing the individual release profile to the innovator brand. The Model-independent factors, similarity (*f2*) and difference (*f1*) factors, are used to evaluate how close the dissolution profiles or drug release pattern of different "supposed" similar batches differ. Two brands are said to be similar if their *f2* values lies between 50-100%. They are said to have minor differences if their *f1* value lies between 0-15. In the previous studies, different methods were used to compare dissolution profiles data (Anderson et al., 1998). However, in this study the two most important and widely used methods have been utilized: the fit factors and dissolution efficiency (D.E.). Therefore, as shown in table 4, only the dissolution profiles of brands BTO, DEO, FCO and GNO were similar with the innovator brand (Zyprexa®) using the *f*2 factor. But using the *f*1 factor all the brands seem to have small difference in their dissolution profile. The similarity factor *f*2 is more sensitive in finding dissimilarity between dissolution curves than the difference factor *f*1, and the values of fit factors are dependent on the number of sampling time points chosen (Costa *et al*., 2003; Costa, 2001; Polli *et al.*, 1997). Table 5.0 shows the dissolution efficiency of different brands along with the differences with the reference brand IZO. The reference and the test product can be said to be equivalent if the absolute difference between their dissolution efficiencies is within appropriate limits (± 10%, which is often used) (Anderson *et al*., 1998). Highest dissolution efficiency was found in case of brand EAO which failed some of the test. With the exception of brand HOO, the remaining brands tested had dissolution efficiencies of more than 70% and may be considered as quality products. Brand AAO, BTO, CIO, DEO, FCO and HOO are equivalent to brand IZO in terms of dissolution efficiency but checking the % DF, it is obvious that only brands BTO, DEO and FCO would probably be interchangeable with each other and with the innovator brand (Zyprexa™) as difference of % DF (test product – reference product) is less than 10. However, the rest of the brands (AAO, CIO, EAO, GNO and HOO) were dissimilar to brand IZO and cannot be considered as interchangeable with the innovator product.

The unit price of the different brands under consideration varied. The innovator brand (IZO) is the most expensive (₦2500/10 mg tablet) as expected (Table 3.1 and Fig. 3.1). samples EAO, FCO, GNO and HQO with the lowest price per tablet (N30/10 mg tablet) were Indian brands. The implication of this is that if all the brands were to be therapeutically and pharmaceutically equivalent, the price of one packet (10 mg x 7) of sample IZO will purchase doses for one year of samples that cost ₦30/10 mg tablet for one year duration.

CONCLUSION

This study revealed that not all brands of olanzapine studied met the USP specification, as some of the brands failed one or more of the tests. It is however evident from the study that only Teva-Olanzapine® showed very similar dissolution profiles with the innovator product Zyprexa®, and can be interchanged. In view of the results obtained from this study, the cost implication of Olanzapine tablets in the management of schizophrenia could be reduced by using Teva-Olanzapine®.

The study made use of one batch for each brand. As a result of logistic and economic challenges encountered, this study use a single batch of the available brands. The evaluation of additional lots and batches is however necessary to establish a consistent batch-batch reproducibility and to efficiently detect substandard lots, which is another important aspect of the quality control of multi-sourced products. The study therefore recommends that routine evaluation of available marketed products is done to provide updated information on the bioavailability and interchangeability of products.

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