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Microbial Purity and Ibuprofen Contents in Four Branded Ibuprofen Tablets Sold within Minna City, Nigeria

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ABSTRACT

Background: Ibuprofen tablets have both analgesic and anti-inflammatory properties. The presence of substandard Ibuprofen tablets in the markets is worrisome. As a result of this, there is a need to have Ibuprofen tablets whose microbial purity and Ibuprofen contents meet the stated specifications.
Objectives: To assess the microbial purity and Ibuprofen contents of four branded Ibuprofen tablets sold within Minna city, Nigeria.
Methods: The assay of four branded Ibuprofen tablets was determined using UV spectrophotometric and titrimetric methods while the microbial load was determined using microbial purity test.
Results: The assay values and percentages when the UV spectrophotometric method was used ranged between 397.05-412.64 mg while the titrimetric method ranged from 381.34-401.02 mg. *Escherichia coli*, *Shigella dysenteriae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* were absent in all the selected Ibuprofen tablets while non-pathogenic bacteria and fungi recorded a value of less than 10 cfu/ml respectively.
Conclusions: The four branded Ibuprofen tablets (400 mg) sold within Minna city, Nigeria differs in Ibuprofen contents and the microbial purity results were in conformity with the stated specifications.

Keywords: Microbial purity of drugs, Ibuprofen tablets, Ibuprofen in Minna city

INTRODUCTION

The need to have high-quality Ibuprofen tablets that are safe, effective and of high microbial purity cannot be overstressed. Ibuprofen tablets sold in Nigerian markets are in different formulations (capsules, tablets and caplets). The strength of Ibuprofen tablets can be 200 mg or 400 mg. It was reported in the works of Rainsford (2009) and Mazaleuskaya *et al*. (2015) that Ibuprofen tablets have been used for the treatment of fever, pain and inflammation. The route of administration as opined by Kandreli *et al*. (2013) in both children and adults is oral. The adult dose is 200-400 mg while the children's dose is 5-10 mg/kg every 4-6 h. The maximum dose of up to 1.2 g can be taken by adults per day. As reported by Gigante and Tagarro (2012) and Kandreli *et al*. (2013), Ibuprofen though not the most effective of all the non-steroidal drugs available in the market, its usage is effective and safe over a wide dosage range. Its availability and cost-effectiveness contributed to its patronage.

As opined by Gigante and Tagarro (2012) and Kandreli *et al*. (2013), Ibuprofen is effective in treating different pains (muscular/joint, teeth, postoperative, migraine). Headaches, rheumatism, arthritis, ankylosing spondylitis and osteoarthritis are also treated using Ibuprofen (Gigante and Tagarro, 2012; Kandreli *et al*., 2013). According to Okunlola *et al*. (2009) and Eichie *et al*. (2009), physicochemical and bio-equivalence differ in different Ibuprofen tablets sold in Nigerian markets. Auta *et al*. (2014) reported that cost, safety, efficacy and esthetic packaging are some of the challenges among others that daily confront health caregivers and community pharmacists when selecting effective drugs to be given to patients. Therefore, there is a need to determine the physicochemical and microbial purity of different drugs sold in different markets in

Nigeria (Nnamdi *et al*., 2009). Microbial purity and Ibuprofen contents in four branded Ibuprofen tablets sold within Minna city, Nigeria is the focus of this study.

MATERIALS AND METHODS

Study Area

The study covers selected and registered Pharmacy shops located within Minna city, Nigeria.

Collection of Samples

Four different brands of Ibuprofen tablets (400 mg) were bought from each of the 15 registered pharmacy shops located within Minna city. The branded Ibuprofen tablets were coded as SB; IB; VF and MK. The 60 samples of the four branded Ibuprofen tablets were taken to the laboratory for assay and microbial purity tests respectively.

Determination of Ibuprofen Content in Ibuprofen Tablets

Assay

The assay of the Ibuprofen contents in the Ibuprofen tablets was determined using UV spectrophotometric and titrimetric methods.

A. UV Spectrophotometric Method

The assay of Ibuprofen content in the Ibuprofen tablet was determined using the UV spectrophotometric method as outlined in the work of Sylvester *et al*. (2015). The method was carried out as follows:

1. Standard Sample

A standard solution (10 µg/ml) was prepared by dissolving 100 mg of Ibuprofen powder with 0.1M NaOH solution in a 100 ml volumetric flask and made up to the 100 ml mark. The desired concentration was obtained by diluting 1 ml aliquot of the resulting solution to 100 ml and the absorbance determined at 221 nm. The percentage assay and stated Ibuprofen content per tablet were calculated using equations 1 and 2 respectively.

$$\text{Percentage Assay} = \frac{\text{Absorbance of test}}{\text{Absorbance of standard}} \times 100 \ldots\ldots. 1$$

$$\text{Stated Content/Tablet} = \frac{\text{Percentage Assay}}{100} \times 400 \ldots.2$$

2. Test Sample

Twenty (20) Ibuprofen tablets were weighed and the average weight determined. With the aid of ceramic mortar and pestle, the tablets were crushed into powders. A quantity equivalent to 100 mg of powdered Ibuprofen powder was weighed and dissolved with 0.1M NaOH solution and made up to the mark in a 100 ml volumetric flask. This preparation gave a solution of 10 µg/ml and then filtered with the aid of the Whatman filter paper (No. 1). The desired concentration was obtained by diluting 1 ml aliquot of the solution to 100 ml in a 100 ml volumetric flask. The absorbance of the resulting solution was determined at 221 nm and the percentage assay and stated content per tablet was calculated using equations 1 and 2 respectively.

B. Titrimetric Method

The titrimetric method to determine the Ibuprofen contents in Ibuprofen tablets was carried out as outlined in British Pharmacopeia (B. P) (2009). A 0.450 g of Ibuprofen tablet was dissolved in 50 ml of methanol followed by the addition of 0.40 ml of phenolphthalein solution and titrated with 0.1M sodium hydroxide. The titration was completed when a red colour was obtained. A blank titration minus the sample was also carried out. Each ml of 0.1M sodium hydroxide is equivalent to 20.63 mg of $C_{13}H_{18}O_2$.

The Ibuprofen content and the percentage assay limit in Ibuprofen tablets for both UV spectrophotometric and titrimetric methods is 380-420 mg and 95-105% respectively (B. P, 2009).

Microbial Purity Test

Preparation of Culture Media

The isolation of the pathogenic bacteria was carried out using the following culture media: Lactose Broth, Nutrient Broth, Cetrimide Agar, Mannitol Salt Agar, Salmonella-Shigella Agar and Eosin Methylene Blue Agar. Non-pathogenic bacteria were isolated using Nutrient agar and Nutrient Broth while the fungi were isolated using Sabouraud Dextrose Broth and Sabouraud Dextrose Agar. The media were prepared according to the manufacturer's instructions.

Preparation of Drug Homogenate

The drug homogenate was prepared as outlined in the modified method of Oloninefa *et al*. (2016). Two Ibuprofen tablets were delivered aseptically into 90 ml of sterilized deionized water and allowed to dissolve completely by mixing thoroughly.

Preparation of Serial Dilution

Three millilitres (3 ml) were withdrawn from drug homogenate aseptically and 1 ml each was delivered into 9 ml of sterilized Lactose Broth, Nutrient Broth and Sabouraud Dextrose Broth to obtain a dilution factor of 10^{-1} (Collins *et al*., 1995).

Inoculation and Incubation of Culture Media

The sterilized culture media (Mannitol Salt Agar, Salmonella Shigella Agar and Eosin Methylene Blue Agar) were inoculated with a loopful from 10^{-1} Lactose Broth. The sterilized Nutrient Agar and Cetrimide Agar were inoculated with a loopful from 10^{-1}Nutrient Broth while the Sabouraud Dextrose Agar was inoculated with a loopful from 10^{-1} Sabouraud Dextrose Broth. The inoculation was carried out using a flamed wire inoculating loop. The inoculated culture media (Lactose Broth, Mannitol Salt Agar, Salmonella-Shigella Agar, Cetrimide Agar and Eosin Methylene Blue Agar) were incubated at 37^{o}C for 24-48 h while the Nutrient Broth and Nutrient Agar were incubated at 37^{o}C for 24-72 h. However, Sabouraud Dextrose Broth and Sabouraud Dextrose Agar were incubated at room temperature for 72-120 h (Cheesbrough, 2010).

Enumeration of the Organisms

The enumeration of the organisms was carried out by multiplying the number of viable, visible, separated and distinct colonies by the reciprocal of the dilution factor and expressed the results as colony-forming unit per millilitre (cfu/ml) (Cheesbrough, 2010).

RESULTS

Ibuprofen Contents in Ibuprofen Tablets using UV Spectrophotometric Method

Table 1 shows the results of Ibuprofen contents in Ibuprofen tablets using the UV spectrophotometric method. The range of Ibuprofen contents in VF, SB, IB and MK were in this order: 412.08-412.48 mg, 411.89-412.64 mg, 409.78-410.87 mg and 397.05-400.06 mg respectively.

Ibuprofen Contents in Ibuprofen Tablets using Titrimetric Method

Table 2 shows the results of Ibuprofen contents in Ibuprofen tablets using the titrimetric method. The range of values obtained for VF, IB, MK and SB were in this order: 399.36-401.02 mg; 392.06-393.32 mg; 384.92-386.05 mg and 381.34-382.07 mg.

Table 1: Ibuprofen Contents in Ibuprofen Tablets using UV Spectrophotometric Method

	Coded Ibuprofen Tablets (Limit: 380-420 mg)			
Pharmacy Shops	IB	SB	VF	MK
Hephzibah	410.22±0.06^{a,b}	412.39±0.12^{a,b}	412.17±0.06^{a,b}	397.56±0.21^{a,b}
Namibis	410.65±0.39^{b}	412.44±0.33^{a,b}	412.08±0.04^{a}	397.05±0.12^{a}
Leyjay	409.78±0.41^{a}	412.17±0.15^{a,b}	412.20±0.08^{a,b}	397.16±0.06^{a}
Femad	410.51±0.33^{a,b}	412.16±0.13^{a,b}	412.13±0.06^{a,b}	397.17±0.10^{a}
Mudos	410.25±0.15^{a,b}	412.32±0.23^{a,b}	412.48±0.17^{b}	397.47±0.25^{a,b}
Kaaye	410.58±0.28^{a,b}	412.05±0.14^{a,b}	412.29±0.12^{a,b}	399.51±1.19^{a,b,c}
Godiya	410.24±0.18^{a,b}	412.15±0.04^{a,b}	412.18±0.02^{a,b}	398.79±0.77^{a,b,c}
Garima	410.21±0.09^{a,b}	412.17±0.16^{a,b}	412.23±0.14^{a,b}	398.53±1.29^{a,b,c}
Zagbayi	410.39±0.21^{a,b}	412.22±0.06^{a,b}	412.27±0.13^{a,b}	399.13±0.99^{a,b,c}
Florens	410.46±0.19^{a,b}	412.42±0.35^{a,b}	412.46±0.05^{b}	399.32±0.93^{a,b,c}
Nakowa	410.12±0.15^{a,b}	412.22±0.10^{a,b}	412.31±0.11^{a,b}	398.89±0.67^{a,b,c}
Honey-Drops	410.87±0.32^{b}	412.64±0.31^{b}	412.27±0.12^{a,b}	397.85±0.71^{a,b,c}
Ajib	410.19±0.04^{a,b}	411.89±0.17^{a}	412.42±0.11^{a,b}	400.06±0.26^{c}
Asmau	410.34±0.29^{a,b}	412.21±0.09^{a,b}	412.38±0.17^{a,b}	399.06±1.10^{a,b,c}
Okoma	410.34±0.02^{a,b}	412.31±0.02^{a,b}	412.23±0.08^{a,b}	399.94±0.26^{b,c}

Results represent mean ± standard error of the mean of triplicate determination. Values with the same superscript in the same column are not significantly different at $p<0.05$

Table 2: Ibuprofen Contents in Ibuprofen Tablets using Titrimetric Method

Pharmacy Shops	Coded Ibuprofen Tablets (Limit: 380-420 mg)			
	IB	SB	VF	MK
Hephzibah	392.90±0.26^{a,b}	381.34±0.29^{a}	400.73±0.07^{d,e}	385.76±0.03^{a,b,c,d}
Namibis	393.32±0.73^{b}	381.49±0.30^{a,b}	399.36±0.27^{a}	385.76±0.03^{a,b,c,d}
Leyjay	392.44±0.23^{a,b}	381.36±0.20^{a}	400.58±0.03^{c,d,e}	385.50±0.42^{a,b,c,d}
Femad	393.29±0.23^{b}	381.84±0.06^{b,c,d,e}	401.00±0.30^{e}	385.93±0.20^{c,d}
Mudos	392.43±0.11^{a,b}	381.75±0.03^{a,b,c,d,e}	400.13±0.04^{b,c,d}	385.23±0.30^{a,b,c,d}
Kaaye	392.81±0.04^{a,b}	381.61±0.03^{a,b,c}	400.67±0.06^{c,d,e}	385.01±0.38^{a,b}
Godiya	392.59±0.10^{a,b}	381.46±0.04^{a,b}	401.02±0.24^{e}	385.15±0.45^{a,b,c}
Garima	392.06±0.19^{a}	381.49±0.04^{a,b}	400.79±0.13^{e}	385.30±0.16^{a,b,c,d}
Zagbayi	392.32±0.03^{a}	382.07±0.10^{e}	399.75±0.42^{a,b}	385.20±0.31^{a,b,c}
Florens	392.48±0.33^{a,b}	381.58±0.03^{a,b,c}	400.59±0.03^{c,d,e}	386.05±0.03^{d}
Nakowa	392.75±0.35^{a,b}	382.02±0.03^{d,e}	400.76±0.06^{d,e}	385.57±0.27^{a,b,c,d}
Honey-Drops	392.58±0.08^{a,b}	381.55±0.04^{a,b}	400.97±0.19^{e}	385.81±0.12^{b,c,d}
Ajib	392.57±0.10^{a,b}	381.53±0.02^{a,b}	400.06±0.27^{b,c}	384.92±0.20^{a}
Asmau	392.66±0.02^{a,b}	381.97±0.06^{c,d,e}	400.66±0.07^{c,d,e}	385.67±0.10^{a,b,c,d}
Okoma	392.66±0.12^{a,b}	381.63±0.03^{a,b,c,d}	400.57±0.01^{c,d,e}	385.74±0.12^{a,b,c,d}

Results represent mean ± standard error of the mean of triplicate determination. Values with the same superscript in the same column are not significantly different at $p<0.05$

Table 3: Microbial Purity Tests

Organisms	Limits	SB	IB	VF	MK
Escherichia coli (cfu/ml)	NIL	NIL	NIL	NIL	NIL
Shigella dysenteriae (cfu/ml)	NIL	NIL	NIL	NIL	NIL
Staphylococcus aureus (cfu/ml)	NIL	NIL	NIL	NIL	NIL
Pseudomonas aeruginosa (cfu/ml)	NIL	NIL	NIL	NIL	NIL
Non-pathogenic bacteria (cfu/ml)	$\leq 1x10^3$	$< 1x10^1$	$< 1x10^1$	$< 1x10^1$	$< 1x10^1$
Fungi (mould/yeast) (cfu/ml)	$\leq 1x10^2$	$< 1x10^1$	$< 1x10^1$	$< 1x10^1$	$< 1x10^1$

Microbial purity tests

The results of microbiology purity tests are shown in Table 3. There was the absence of *Escherichia coli*, *Shigella dysenteriae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* in all the selected Ibuprofen tablets (SB, IB, VF and MK). A value of less than 10 cfu/ml was obtained for non-pathogenic bacteria and fungi respectively in all the Ibuprofen tablets.

DISCUSSION

The results of the Ibuprofen contents and the percentage of assay of all the selected Ibuprofen tablets (SB, IB, VF and MK) were within the limits stated in the B. P. (2009). These results were in line with the work of Orukotan and Oloninefa (2019) who reported that sterile and non-sterile products must satisfy and meet the specifications set for both microbial purity tests and assay in the pharmacopoeia monographs to ensure that patients/end users use drugs that are of high quality, safe and effective. However, the results obtained using the UV spectrophotometric method were better than the results obtained using the titrimetric method as shown in Tables 1 and 2. The differences in the results may be due to equipment used, laboratory procedures and reagents used as reported by Bonini *et al*. (2002), Calixto (2000) and Wallack (2007).

Furthermore, the absence of pathogenic bacteria such as *Escherichia coli*, *Shigella dysenteriae*, *Staphylococcus aureus* and *Pseudomonas aeruginosa* and the values of less than 10 cfu/ml recorded for non-pathogenic bacteria and fungi

in all the selected Ibuprofen tablets (SB, IB, VF and MK) is in agreement with B. P. (2009). The results obtained may be due to adherence to Current Good Manufacturing Practice (cGMP) during the production of Ibuprofen tablets. As reported in the United States Pharmacopeia (USP) (2003), it is when microbial contaminants exceed the acceptable limits that public health becomes a concern. Bhvani Shankar *et al*. (2016) opined that a significant deviation is caused by the presence of microbial contaminants. In addition, there are changes in the physical, chemical and organoleptic of the drug as well (Bhvani Shankar *et al*., 2016). Therefore, there is a need to assess the Ibuprofen contents in Ibuprofen tablets and determined their microbial loads to prevent out of specifications and make available Ibuprofen tablets that are effective and potent in Nigerian markets (Orukotan and Oloninefa, 2019).

CONCLUSION

The results obtained for selected Ibuprofen tablets sold within Minna city showed that both the assay and the microbial purity tests were within the stated limits despite the fact they were of different brands. Thus, they were of high pharmaceutical quality.

However, the use of the UV spectrophotometric method should be encouraged when determining the assay of Ibuprofen content in the Ibuprofen tablet as it gives a better result compared to the use of the titrimetric method. Adherence to Current Good Manufacturing Practice (cGMP) should be encouraged to consistently obtain assay and microbiology purity results that are within the stated limits.

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REFERENCES

Auta, A., Bala, E. T. and Shalkur, D. (2014). Generic medicine substitution: a cross-sectional survey of the perception of pharmacists in North Central, Nigeria. *Medical Principles and Practice*, 23(1): 53-8.

Bhvani Shankar, L., Gangadharappa, H. V. and Kiran, H. C (2016). Handling of Reserve Samples in Pharmaceutical Industries. *International Journal of Pharmaceutical Sciences Review and Research*, 37(2): 27-29.

Bonini, P., Plebani, M., Cerrioti, F. and F. Rubboli, F. (2002). *Errors in laboratory medicine. Clinical Chemistry*, 48: 691-698.

British Pharmacoepeia (2009). Volumes I and IV. In: Monograph for Ibuprofen and Microbiological Quality of Pharmaceutical Preparations. 2009 edition (pp. 1048-1050, A426-A427). London: The Stationery Office.

Calixto, J. B. (2000). Efficacy, safety, quality control, marketing and regulatory guidelines for herbal medicines. *Brazilian Journal of Medicine and Biological Research*, 33: 179-189.

Cheesbrough M (2010). Laboratory Manual. In: *District Laboratory Practice in Tropical Countries* (pp.146-157). United Kingdom: Cambridge University Press.

Collins, C. H., Patricia, M. L. and Grange, J. M. (1995). Collins and Lyne's Microbiological Methods, 7th Ed. (pp. 117). United Kingdom: Butterworth-Heinemann.

Eichie, F. E, Arhewoh, I. M. and Ezeobi, O. C. (2009). In-vitro evaluation of the pharmaceutical quality of some ibuprofen tablets dispensed in Nigeria. *African Journal of Pharmacy and Pharmacology*, 3(10): 491-5.

Gigante, A. and Tagarro, I. (2012). Non-steroidal anti-inflammatory drugs and gastroprotection with proton pump inhibitors: a focus on ketoprofen/ omeprazole. *Clinical Drug Investigation*, 32(4): 221-33.

Kandreli, M. G., Vadachkoriia, N. R., Gumberidze, N. S. and Mandzhavidze, N. A. (2013). Pain management in dentistry. *Georgian Med News*, 225: 44-9.

Mazaleuskaya, L. L., Theken, K. N., Gong, L., Thorn, C. F., FitzGerald, G. A. and Altman, R. B. (2015). PharmGKB summary: ibuprofen pathways. *Pharmacogenet Genomics*, 25(2): 96- 106.

Nnamdi, J. A., Arhewoh, I. M., Okhamafe, A. O. andEnato, E. F. (2009). Evaluation of the pharmaceutical quality of some quinine preparations sold in Nigeria. *Medical Principles and Practice*, 18: 193-7.

Okunlola, A., Adegoke, O. A. and Odeku, O. A. (2009). Generic versus innovator: analysis of the pharmaceutical qualities of paracetamol and ibuprofen tablets in the Nigerian market. *East and Central African Journal of Pharmaceutical Sciences*, 12: 55-64.

Oloninefa, S. D., Abalaka, M. E. and Daniyan, S. Y. (2016). Determination of the Rate of Killing of the Antibiotics Effective against *C. sakazakii*. In: *Antibacterial Susceptibility of C. sakazakii to Known Antibiotics*. 1st edition (pp. 65), Saarbrucken, Deutschland, Germany: Lambert Academic Publishing Omniscriptum GmbH & Co. KG, BahnhofstraBe, 28, 66111.

Orukotan, A. A. and Oloninefa, S. D. (2019). Impact of Trend Analysis on Quality of Finished Products in a Pharmaceutical Industry. *Umaru Musa Yaradua Journal of Microbiology Research*, 4 (1): 72 – 76.

Rainsford, K. D. (2009). Ibuprofen: pharmacology, efficacy and safety. *Inflammopharmacology*, 17(6): 275-342.

Sylvester, O. E., Mathew, I. A., Rosemary N. C. and Magnus, A. I. (2015). A comparative UV−HPLC analysis of ten brands of ibuprofen tablets. *Asian Pacific Journal of Tropical Biomedicine*, 5(10): 880–884.

United States Pharmacopeia (USP-62) (2003).Microbiological examination of non-sterile products: Tests for specified microorganisms. *Pharmacy Forum*, 29(5): 1722-1733.

Wallack, J. B. (2007). Interpretation of diagnostic tests. Eight edition (22-50). Philadelphia: Lippincott Williams & Wilkins.