

The quality of veterinary medicines and their implications for One Health

Supplemental material 6. Characteristics of prevalence surveys of veterinary medicines

Reference/ country of collection	Active pharmaceutical ingredients (API)	Brand name	Outlet/Sampling type	Reference specifications standard	Test(s) performed and <u>analytical technique for API content/Impurities</u>	Failure frequency % (n/N)
Farah, 2016 [1] Unknown	Ciprofloxacin	Unknown	Online retrieval/ Unknown	USP	API content, Weight uniformity <u>HPLC</u>	80.0% (4/5)
Dicko, 2010 [2] Mali	Oxytetracycline	Unknown	Unknown/ Unknown	International Pharmacopeia European Pharmacopeia USP	API identification, API content, sterility test, pH measurement. <u>TLC, UV-visible spectrophotometry</u>	10.8% (13/120)
Greter, 2016 [3] Chad	Albendazole	Albaneet Alben (green) Alben (white) Albendazole Albenor Benzal Ceva Vermitan NB LOBS Alben	Village markets, health centres, unlicensed outlets, private pharmacies and veterinary pharmacies/Convenience	Conduct of analysis as per Pharmacopoeial status stated on label	API content <u>HPLC-UV</u>	46.7% (7/15)
Ndayisenga, 2009 [4] Rwanda	Albendazole Diminazen-Phenazone Isoniazidum Ivermectin Levamisole	Unknown	Import, wholesalers- distributors and veterinary pharmacies/Convenience	European Pharmacopeia	API content, Appearance, Mass uniformity, Disintegration	65.1% (54/83)

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	Oxytetracycline				<u>HPLC-UV</u>	
Teko-Agbo, 2003 [5] Benin & Togo	Albendazole Diminazen Isometamidium	Unknown	Unlicensed outlets, wholesalers, veterinary clinic/Random	European Pharmacopeia	API content, Appearance, Disintegration, pH measurement, mass uniformity <u>HPLC, UV-Spectrometry</u>	33.3% (12/36)
Tekle, 2018 [6] Ethiopia	Isometamidium Diminazen	Unknown	Unlicensed outlet, wholesalers, government clinic, private veterinary pharmacy/Convenience	Conduct of analysis as per Pharmacopoeial status stated on label	API content <u>HPLC</u>	28.0% (14/50)
Teko-Agbo, 2009 [7] Cameroun & Senegal	Albendazole Diminazen Ivermectine Levamisole Oxytetracycline	Unknown	Wholesalers, veterinary clinics and pharmacies, unlicensed outlets/Random	European Pharmacopeia	API content, Appearance, mass uniformity, pH measurement, disintegration <u>HPLC</u>	73.8% (76/103)
Adu, 2016 [8] Ghana	Oxytetracycline Praziquantel	Unknown	Farms, veterinary hospitals, facilities providing medicines (veterinary shops) and manufacturer/Convenience	BP 2013 USP 35	API content <u>HPLC-UV</u>	52.0% (13/25)
Assoumy, 2009 [9] Ivory coast	Albendazole Diminazen Isometamidium Ivermectine	Unknown	Wholesalers, distributors and unlicensed outlets/Random and convenience	European Pharmacopeia	API content, mass uniformity, disintegration	43.0% (34/79)

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	Oxytetracycline				<u>HPLC-UV</u>	
Tetty, 2001 [10] Angola CAF DR Congo Ivory Coast Malawi Mali Mozambique Namibia Nigeria Senegal Togo	Diminazen-Phenazone	Berenil Diamyl Diminal Diminaphen Diminasan Diminaveto Diminaze Diminazen Nortryp Nozomil Samorenil Sangavet Trypamyl Trypan Trypazen Veriben Veriben solution	Private pharmacies, veterinary clinics, unlicensed outlets and government supply/ Unknown	BP	API content <u>HPLC-DAD</u>	48.5% (50/103)
Vougat, 2017 [11] Cameroon	Oxytetracycline Levamisole Procaine-penicillin G Diminazen	Oxy5% Oxytet ⁵ Faroxy5% Bolumisole 1 Bolumisole 3 Fortified Procaine Penicillin Permacain Veriben Diminakel Plus	Unlicensed outlets/ Convenience	Conduct of analysis as per Pharmacopoeial status stated on label.	API content, contaminants <u>HPLC, GC/MS</u>	96.3% (26/27)

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Phu, 2015 [12] Vietnam	Sulfamethoxazole-trimethoprim Sulfadiazine-trimethoprim Doxycycline-florfenicol Florfenicol-cefalexin Florfenicol-amoxicillin Amoxicillin-ciprofloxacin Florfenicol Doxycycline Amoxicillin	Unknown	Chemical shops/ Convenience	Conduct of analysis as per Pharmacopoeial status stated on label.	API content <u>UPLC-MS/MS, HPLC-UV</u>	78.1% (25/32)
Tran, 2017 [13] Vietnam	Enrofloxacin-ciprofloxacin-amoxicillin Enrofloxacin-oxytetracycline-florfenicol Oxytetracycline-sulfadimethoxin-ormetoprim Sulfamethoxazole-trimethoprim-rifamcine Streptomycin-neomycin-allicin Doxycycline-Oxytetracycline Enrofloxacin-Oxytetracycline Sulfadimethoxin-ormetoprim	Unknown	Chemical shops/ Convenience	Conduct of analysis as per Pharmacopoeial status stated on label.	API content <u>UPLC-MS/MS</u>	92.9% (26/28)

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	Sulfamethoxazole-trimethoprim Doxycycline-rifampicin Erythromycin-rifampicin Sulfadiazine-trimethoprim Ciprofloxacin Oxytetracycline Neomycin Florfenicol					
Shamaki, 2018 [14] Nigeria	Oxytetracycline Sulphadiazine-trimethoprim Fortified procaine penicillin Albendazole	Unknown Vetcotrim	Veterinary shops/ Convenience	BP USP	API content <u>UV-visible spectrophotometry</u>	25.0% (1/4)
Bengaly, 2018 [15] Benin Burkina Faso Ivory Coast Mali Niger Togo	Diminazen Isometamidium	Unknown	Official: wholesalers, veterinary clinics and veterinary pharmacies Unofficial sources: local market street vendors/ Unknown	World organization for animal health (OIE) monograph	API content <u>HPLC</u>	47.1% (146/310)
Li, 2018 [16] China	Amoxicillin Enrofloxacin Florfenicol Sulphadiazine-trimethoprim	Unknown	Chemical supply shops/ Random	Veterinary pharmacopoeia of the people's republic of China	API content, API screening <u>HPLC-PDA, UPLC-MS/MS</u>	76.4% (54/71)

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	Sulphamonomethoxine					
Ratalata, 2008 [17] Madagascar	Oxytetracycline Albendazole Levamisole Closantel	Unknown	Wholesalers, veterinary pharmacies, distributors, unlicensed outlets/ Unknown	European Pharmacopeia	API content, appearance, pH measurement, disintegration, mass uniformity <u>HPLC-UV</u>	57.9% (33/57)
Yen, 2019 [18] Vietnam	Oxytetracycline-Colistin Amoxicillin-Colistin Oxytetracycline-Streptomycin Thiamphenicol-Sulfamethoxazole Tylosin-Gentamicin Doxycycline-Tylosin Erythromycin-Sulfamethoxazole Gentamicin-Tylosin Tilmicosin Enrofloxacin Amoxicillin-Tylosin Oxytetracycline Neomycin-Colistin Trimethoprim-Colistin	Unknown	Veterinary drug shops/ Convenience	Conduct of analysis as per Pharmacopoeial status stated on label.	API content <u>UPLC-MS/MS</u>	69.5% (41/59)
Ud Din, 2017 [19] Pakistan	Doxycycline-Tylosin	Unknown	Unknown/ Convenience	BP	API content <u>HPLC-UV</u>	50.0% (4/8)
Leung, 2020 [20]	Florfenicol Oxytetracycline	Unknown	Unknown/ Convenience	Conduct of analysis as per Pharmacopoeial	API content	48.4% (15/31)

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Hong Kong				status stated on label.	<u>HPLC</u>	
Note: HPLC: High-performance liquid chromatography; TLC: Thin-layer chromatography; HPLC-UV: High-performance liquid chromatography with UV detector; HPLC-DAD: High-performance liquid chromatography with diode-array detector; GC/MS: Gas chromatography-mass spectrometry; UPLC-MS/MS: Ultra-performance liquid chromatography-tandem mass spectrometer HPLC-PDA: High-performance liquid chromatography with photodiode-array detector USP: United States Pharmacopeia; BP: British Pharmacopeia						

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