



Changes in drug availability patterns on Tanzanian mainland: The effects of the surge operations deterrent strategy

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ABSTRACT

This study investigated the recent changes in illegal substances availability on the Tanzanian mainland as a result of the government's surge operations as a deterrent approach against illicit drug production, trafficking and usage from 2017 to 2020, as well as the consequences of the COVID-19 pandemic on the drug market. Overall, 247467 seizures of illegal substances weighing 25357.9 kg were tested at The Government Chemist Laboratory Authority (GCLA), an average of 6339.5 kg annually. According to the findings, cannabis was the most frequently encountered substance, accounting for 80.6%, 88.2%, and 83% of all incidents, samples, and weight, respectively. Heroin came in second with 12.6% of the total incidents and 7.4% of the total number of samples, while khat came in second with 15.2% of the weight of the seized illegal substances during the period under study. Apart from a 202 and 4709 decline in heroin incidents and samples, the weight jumped from 15.3 kg in 2017 to 303.5 kg in 2020. Generally, the overall weight of the seizures decreased by 67.3% from 13036.4 kg in 2017–3890.7 kg in 2020. The results were particularly noticeable in the case of cannabis, which plunged by 76.5% from 11771.1 kg in 2017–2727 kg in 2020. Despite the eruption of the COVID-19 pandemic and associated lockdowns and travel limitations, heroin seizures increased by 67.4% in 2020 compared to the preceding three years combined.

1. Introduction

Illicit drug usage and supply have long been a source of worry in developed and developing countries, posing societal difficulties such as health issues, security threats, and political instability [1]. However, over the previous two decades, the global population of drug users has gradually increased. For example, in 2009, 210 million people (4.8%) used drugs compared to 269 million (5.3%) users in 2018 among the global population aged 15 to 64 [2–5]. Even though drug use and supply have a long history, it has been mostly a concern in developed countries, with pockets of new hot spots in developing ones. However, developing countries have experienced a faster surge in illicit drug use than developed countries, which can directly be linked to the high growth of the young population in developing nations by 28% compared to developed countries which are 7% of the total population [2–5].

According to the UNODC data, the volume of illicit drugs seized and the number of users increased significantly in 2019 compared to 2018, when 8143 tons of illicit drugs were seized globally and a total of 360 million users [2]. *Cannabis sativa* was the most commonly seized substance and had the highest number of users worldwide. Illegal substance

addiction costed 18 million healthy years of life in the same year, primarily because of opioids, and caused the deaths of around 500,000 people [6]. Beyond the risks to one's health, the illicit drug trade continues to hinder social and economic advancement, disproportionately hurting the poor and disenfranchised, and it seriously jeopardizes international peace and stability [6].

The significant increase in drug consumption, emerging new patterns of synthesis, technological advances, and associated drug-related problems such as crimes, community safety, HIV infection, corruption, and general political instability in a significant number of developing countries all point to the transnational nature of drug use and supply [1, 7–11]. According to Vandam et al. the artistic and fashionable elites dominate drug users' population features, with youngsters being the most impacted [1]. Based on the number of deaths, healthy lives lost, and illegal drugs seized amounts, the fight against illicit drug manufacturing, trafficking/supply, and usage is undeniable.

Despite the outbreak of the COVID-19 pandemic, illicit drug manufacture, trafficking, and delivery persisted in 2020, with substantial quantities of drugs reported to be captured globally. Moreover, the COVID-19 lockdown hastened the development of new drug trafficking

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tactics, including huge shipments, private aircraft, waterways, and contactless methods of delivering drugs to end users [6].

The most commonly encountered illicit substances in Tanzania are divided into natural and synthetic illicit drugs. For this study, the natural illegal substances are cannabis and Khat, which are locally produced. Cocaine, heroin, ketamine, benzodiazepines, and ATS are synthetic and semi-synthetic drugs. Heroin is frequently trafficked into Tanzania from South West Asia via the east coast of Africa over a maritime route known as the "southern route" [12–20]. At the same time, cocaine is imported in exchange for heroin from South America. War and increased law enforcement along the land-based Southeastern Europe trafficking route to Western Europe have given rise to a network of routes that spans East and Southern Africa [12–20]. Illegal substance traffickers use existing weaknesses in the country, like the extensive coastline along the Indian Ocean, permeable borders, continuous corruption, and inadequate port security, to carry out their illegal operations [12–20]. Tanzania also serves as a transit country for methamphetamine headed for other Asian countries and the Southern African market. However, the synthetic drug industry is extremely small in comparison to the cannabis market.

Following an increase in Tanzanians involved in illicit drug trafficking, the government implemented a Surge Operations Deterrent Strategy (SODS) with the primary purpose of curbing drug supply, demand, and harm. To restrain drug trafficking in the country, unprecedented illicit substance policy reforms were implemented, including punishment, forced treatment, and drug users' criminalization methods. The plan was preceded by the passage of a drug control and enforcement statute, which resulted in the establishment of the Tanzanian Drugs Control and Enforcement Authority (DCEA) in September 2015, following the passage of a new Drug Control and Enforcement Act by Parliament. Positive drug drop signs have been reported since then, but no rigorous scientific investigation has been done to establish the methods' effectiveness [21].

This study evaluated the success of the surge strategy by evaluating data on illegal substance seizures in order to provide a complete picture of the illegal substances in Tanzania's mainland from 2017 to 2020 and the effects of the COVID-19 outbreak on the illegal substances' availability in the country.

2. Materials and methods

2.1. Materials

The illegal substances explored in this study were intercepted by the Police Force, the Drug Control and Enforcement Authority and other law enforcement agencies during transportation and seized from drug markets and cannabis farms from various regions of Tanzania's mainland. Except for Khat, which was stored in the freezer to prevent degradation, all other illegal substances seized were kept at ambient temperature.

2.2. Methods

2.2.1. Identification and general analytical schemes

A binocular microscope with a 40x magnification was used to identify the microscopic characteristics of *Cannabis sativa* L. Illegal substances tests were done by screening and confirmatory assays advised by UNODC. The sections that follow provide more information on sample preparation and instrumentation.

2.2.2. Sample preparation

2.2.2.1. Cannabis. One gram of finely ground cannabis soaked for an hour in 10 mL of methanol was vortexed for 2 min after, and then it was sonicated for 30 min. The mixture was re-vortexed for 5, 10, and 15 min, filtered and centrifugated at 13000 rpm for 10 min. The final analysis solution was made by diluting 100 μ L of supernatant with 900 μ L of the

mobile phase of 1:1 acetonitrile: water mixture and injecting it into the LC-MS/MS instrument.

2.2.2.2. Cocaine. Cocaine was investigated using both GC-MS/MS and LC-MS/MS. The cocaine sample was ground and homogenized into a fine powder. The GC-MS/MS analysis solution was prepared by adding 1 mL of methanol to 1 mg of the powder, vortexed, and then evaporated almost completely with a stream of nitrogen. The residue was reconstituted with 1 mL dichloromethane and centrifugated at 13000 rpm for 10 min. The supernatant was then combined with 950 μ L of dichloromethane and injected into the GC-MS/MS instrument. In LC-MS/MS, 50 μ L of supernatant were mixed with 950 μ L of the mobile phase before injecting into the instrument for analysis.

2.2.2.3. Heroin. 1 mg of heroin was dissolved in 1 mL methanol, vortexed then centrifugated for 10 min at 13000 rpm. 50 μ L of the supernatant was mixed with 950 μ L of the mobile phase and then injected into the LC-MS/MS instrument.

2.2.2.4. Benzodiazepines. Benzodiazepine-containing soft drinks were analyzed using direct injection. To precipitate the coarse particles, the benzodiazepines containing soft drink samples were vortexed for 5 min and centrifugated at 13000 rpm for 10 min. 1 mL of the supernatant was drawn and filtered. 20 μ L of the filtered sample was injected into the LC-MS/MS instrument. 3 mg of solid benzodiazepines were dissolved in 1 mL of methanol, vortexed, and centrifugated for 10 min at 13000 rpm. 100 μ L of the supernatant was mixed with 900 μ L of the mobile phase and injected into the LC-MS/MS instrument.

2.2.2.5. Amphetamines (ATS). Methamphetamine samples were analyzed using either GC-MS/MS or LC-MS/MS, or both. For GC-MS/MS, 1 mg of pulverized and homogenized powder was mixed with 1 mL of methanol, vortexed, and evaporated almost completely with a stream of nitrogen. The residue was reconstituted in 1 mL dichloromethane and centrifugated at 13000 rpm for 10 min. 50 μ L of the supernatant mixed with 950 μ L of dichloromethane was injected into the GC-MS/MS instrument. For LC-MS/MS, 1 mg of the material was dissolved in 1 mL methanol, vortexed, and centrifugated at 13000 rpm for 10 min. 50 μ L of supernatant were combined with 950 μ L of mobile phase before injection into the instrument.

2.2.2.6. Khat. 3 g macerated leaves were drenched in methanol for 15 min, sonicated for 30 min and then vortexed for 2 min. After the solution had been filtered and condensed to near dryness, 2 mL of 0.2 mol/L sulfuric acid was added. 5 mL dichloromethane was used to remove the natural organic components. The aqueous layer was basified with 3 mL of sodium bicarbonate solution. 5 mL of dichloromethane was added to extract cathinone and cathine. The volume was evaporated almost completely dry using a gush of nitrogen gas. Residue reconstitution was achieved using 1 mL of acetonitrile: water (1:1) and centrifugated for 10 min at 13000 rpm. 200 μ L of supernatant were mixed with 800 μ L of mobile phase for LC-MS/MS analysis.

2.3.1. GC-MS/MS

Agilent 7890B gas chromatography equipped with an HP-5MS capillary column (30 m \times 0.25 mm, 0.25 μ m) coupled with an Agilent Technologies 7000D mass selective detector was used in analyses of the illegal substances. The helium flow rate was set at 1.0 mL/min and the typical GC temperature settings were: injector temperature, 280 $^{\circ}$ C; beginning column temperature, 70 $^{\circ}$ C; hold time, 1.0 min; temperature ramp, 25 $^{\circ}$ C/min 180 $^{\circ}$ C, then 6 $^{\circ}$ C/min to 280 $^{\circ}$ C, ultimate temperature, 280 $^{\circ}$ C; hold period, 13.0 min. With the electron beam energy adjusted to 70 eV, the mass-selective detector was operated in full scan mode in the m/z 50–500 range. The mass spectrum was compared to the Masshunter database from commercial libraries and NIST.

2.3.2. LC-MS/MS

2.3.2.1. Liquid chromatography. A Thermo Scientific Dionex UltiMate 3000 liquid chromatography pump with an OAS autosampler was used to complete a 6-min gradient elution. For mobile phases A and B, the mobile phases were 1% formic acid in water and acetonitrile, respectively. A Thermo Scientific Accucore RP-MS 100 mm × 4.6 mm × 2.6 mm column was used.

2.3.2.2. Mass spectrometry. Compounds were detected on a Thermo Scientific Q Exactive-Orbitrap mass spectrometer equipped with a Thermo Scientific Ion Max source and a heated electrospray (HESI-II) source. Data were acquired in parallel-reaction monitoring (PRM) mode, where a single precursor ion was selected in the quadrupole as a mass filter with an isolation width of 2.0 m/z to improve precursor selection and ion transmission and fragmented in the HCD cell using optimized compound-specific collision energy. The resulting MS/MS product ion spectrum was detected in the Orbitrap detector at a resolution of 35,000 (FWHM at m/z of 200).

2.3.2.3. Data analysis. The data was processed using Thermo Scientific TraceFinder software. The MS/MS spectrum's specific precursor ion mass was used for confirmation.

3. Results and discussion

Forensic drug testing of illegal substances seizures from 2017 to 2020 was conducted at the Government Chemist Laboratory Authority (GCLA). The seized samples were identified and confirmed using standard methods as described above and according to UNODC guidelines.

The forensic investigations of the illegal substances seized from 2017 to 2020 revealed an overall upsurge in incidents, number of samples, and bulkiness of the seized illegal substances as compared to the previous study, which covered the years 2011–2016 [19]. A total of 25357.9 kg, corresponding to 7310 cases and 247467 samples, was seized, representing an increase of 40.3%, 223.1%, and 173.9%, respectively. Overall, cannabis was the most commonly encountered substance, accounting for 80.6% of cases, 88.2% of samples, and 83% of weight, followed by khat and heroin (Table 4; Fig. 4). Khat and heroin accounted for 15.2% and 1.8% of the total weight, respectively. With 12.6% of cases and 7.4% of samples, heroin came in second, while khat came in third with 6.4% and 3.4%, respectively. Cocaine, benzodiazepines, and ATS together accounted for less than 1% of the total weight of all illegal narcotics seized (Tables 1–4, Figs. 1–4).

In contrast to a 41.3% decrease in heroin samples between 2017 and 2020, a progressive increase in weight from 15.3 kg to 303.5 kg was observed. Apart from the lockdowns and travel restrictions imposed due to the outbreak of the COVID-19 pandemic, the amount of heroin confiscated in 2020 topped that of 2017–2019 by about 50%.

Despite an increase in the incidents and samples seized in 2018, the

weight of illicit substances seized fell by 67.4% when compared to 2017. The significant decrease could be linked to the 69.7% and 49.5% weight decrease in cannabis and khat, respectively. As opposed to this, the trend in 2019 and 2020 showed a progressive reduction of incidents and samples, while the weight marginally rose in 2019 and fell in 2020. Tables 1–3 show that each change in the quantity of cannabis instances, samples, or weight had an effect on the final findings.

Tables 1 and 2 show the trend in the total and percentage of each, as well as the number of incidents and samples from 2017 to 2020. Cannabis was the substance most frequently encountered, with the highest percentage of incidents and samples compared to all other substances, as heroin and Khat ranked second and third, respectively. Heroin incidents decreased gradually from 346 in 2017 to 144 in 2020, a decrease of 58.7%. Similarly, the number of instances of khat reduced from 192 to 69 in 2017 and 2020, respectively. Cocaine, benzodiazepines, and ATS each accounted for less than 1% of the total seizures (Tables 1 and 2; Figs. 1 and 2). Additionally, until 2020, there was a gradual decline in the proportion of samples containing heroin and khat, with 7.4% and 4.3% of all samples being confiscated, respectively. Figs. 1 and 2 show the distribution of the number of incidences and samples, respectively.

Table 3 and Fig. 3 the comparison of the weight of samples, total and average weights and the corresponding percentages of seized illicit drugs for the 2017–2020 period. Overall, cannabis accounted for 83% of the entire weight confiscated, trailed by Khat (15.2%) in second place, cocaine, heroin, benzodiazepines, and ATS accounting for less than 10%. Although the number of cannabis instances and samples increased in 2018, the weight decreased by 69.7%, resulting in a 67.4% decline in the total amount of drugs seized that year. The decline in cannabis weight could be linked to a nationwide push to clear cannabis fields in 2017. The largest cannabis seizure was 11771.1 kg in 2017 (Table 3; Fig. 3), followed by a progressive drop in cannabis weight from 2018 to 2020, with reductions of 20.0% and 29.5% in 2019 and 2020, respectively. The observed cannabis trend is in line with a global study that indicated an increase in global cannabis output from 2010 to 2017, a decline in 2018, and a modest rise in 2019 [5]. A similar pattern was noted for heroin, which saw its weight progressively rise from 15.3 kg in 2017 to 303.5 kg in 2020, despite a drop in the number of samples in 2020 compared to 2017.

According to the results of this study, cannabis was the most frequently encountered illegal substance in Tanzania, owing to the fact that it is domestically cultivated in many parts in the country. The cannabis produced in the country is used to feed the internal market and export to neighboring East Africa and other international markets, such as Sudan. However, reduced seizures from 2018 to 2020 show that the surge operation against illicit drugs had brought the production, supply, and use of cannabis under control [12–20].

In general, 2018 had the lowest number of seizures in terms of illicit drug weights compared to previous years, with a total of 4199.0 kg, a 67.4% decline in weight from 2017 (Table 3). The weight of seized heroin samples increased significantly from 15.3 to 303.5 kg in 2017 and

Table 1
Distribution of incidents of illegal substances found between 2017 and 2020.

	Number of Incidents (%) ^a								Total 2017–2020	Average 2017–2020		
	Years											
	2017	2018	2019	2020	2017	2018	2019	2020				
Cannabis	1439	(72.5)	1775	(82.5)	1529	(84.5)	1150	(84.2)	5893	(80.6)	1473	(80.6)
Cocaine	3	(0.2)	3	(0.1)	1	(0.1)	1	(0.1)	8	(0.1)	2	(0.1)
Heroin	346	(17.4)	237	(11.0)	195	(10.8)	144	(10.5)	922	(12.6)	231	(12.6)
Khat	192	(9.7)	133	(6.2)	76	(4.2)	69	(5.1)	470	(6.4)	118	(6.5)
Benzodiazepines	4	(0.2)	3	(0.1)	5	(0.3)	1	(0.1)	13	(0.2)	3	(0.2)
ATS	1	(0.1)	–	3	(0.2)	–	4	(0.1)	1	(0.1)	–	–
Total Cases examined	1985		2151		1809		1365		7310		1828	

^a Proportion of the incidents for the relevant year.

Table 2
Distribution of samples of illegal substances confiscated between 2017 and 2020.

	Number of Samples (%) ^b								Total 2017–2020	Average 2017–2020		
	Years											
	2017		2018		2019		2020					
Cannabis	54792	(81.2)	67738	(89.1)	57475	(92.9)	38296	(90.9)	218301	(88.2)	54575	(88.2)
Cocaine	35	(0.1)	41	(0.1)	43	(0.1)	3	(0.0)	122	(0.0)	31	(0.1)
Heroin	7098	(10.5)	5907	(7.8)	2816	(4.6)	2389	(5.7)	18210	(7.4)	4553	(7.4)
Khat	5565	(8.3)	2231	(2.9)	1473	(2.4)	1420	(3.4)	10689	(4.3)	2672	(4.3)
Benzodiazepines	15	(0)	96	(0.1)	26	(0)	4	(0.0)	141	(0.1)	35	(0.1)
ATS	1	(0)	–	3	(0)	–	4	(0.0)	1	(0.0)	–	–
Total Samples seized	67506		76013		61836		42112		247467		61867	

^b Proportion of the entire sample size for the relevant year.

Table 3
Weight of illegal substances confiscated between 2017 and 2020.

	Weight of Samples in Kg (%) ^c								Total 2017–2020	Average 2017–2020		
	Years											
	2017		2018		2019		2020					
Cannabis	11771.1	(90.3)	3519.0	(83.8)	3022.8	(71.4)	2727.0	(70.1)	21039.9	(83.0)	4354.2	(80.4)
Cocaine	1.6	(0)	5.9	(0.1)	0	(0)	0.1	(0)	7.6	(0)	1.9	(0)
Heroin	15.3	(0.1)	44.1	(1.1)	94.3	(2.2)	303.5	(7.8)	457.2	(1.8)	102.2	(1.9)
Khat	1248.2	(9.6)	630.0	(15.0)	1114.3	(26.3)	860.1	(22.1)	3852.6	(15.2)	959.4	(17.7)
Benzodiazepines	0.2		^b		0.0	(0)	^b		0.2	(0)	–	–
ATS	–		0.0		0.3	(0)	–		0.3	(0)	0.1	(0)
Total weight seized	13036.4		4199.0		4231.9		3890.7		25357.9		5417.8	

^c Proportion of bulkiness of the samples confiscated for the relevant year.

^b Quantity undetermined, sample in solution and combined with soft drinks.

Table 4
Summary of incidents, samples, and weights of illegal substances confiscated between 2017 and 2020.

	Cases (%)		Samples (%)		Weight (%)	
Cannabis	5893	(80.6)	218301	(88.2)	21039.9	(83.0)
Cocaine	8	(0.1)	122	(0)	7.6	(0)
Heroin	922	(12.6)	18210	(7.4)	457.2	(1.8)
Khat	470	(6.4)	10689	(4.3)	3852.6	(15.2)
Benzodiazepines	13	(0.2)	141	(0.1)	0	(0)
ATS	4	(0.1)	4	(0)	0.3	(0)
Total	7310		247467		25357.7	

2020, accounting for 7.8% of the overall weight of illicit narcotics collected, with 2020 being the greatest heroin seizure in comparison to previous years.

The bulkiness of the confiscated samples substantially decreased from 11771.1 kg in 2017–3519 kg in 2018, even though there were more cannabis incidents and samples in 2018. This suggests that the seizures were of tiny packages or rolls meant for internal markets or local drug users rather than bulky packages. This could be regarded as either outcome of the nationwide cannabis farm demolition operations or traffickers inventing novel ways to transport cannabis to escape law enforcement personnel. In 2019 and 2020, a similar trend was seen, with the amount of seized cannabis gradually decreasing, 3022.9 and 2727 kg, respectively.

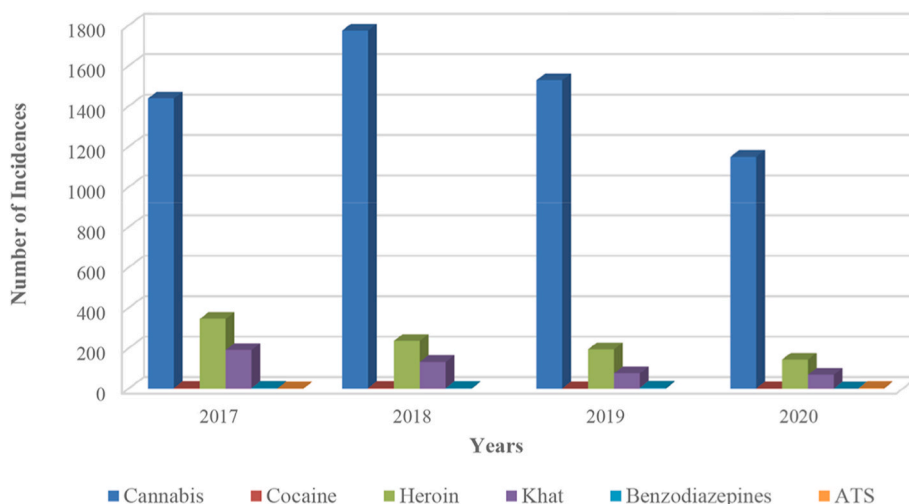


Fig. 1. Distribution of incidents of illegal substances confiscated between 2017 and 2020.

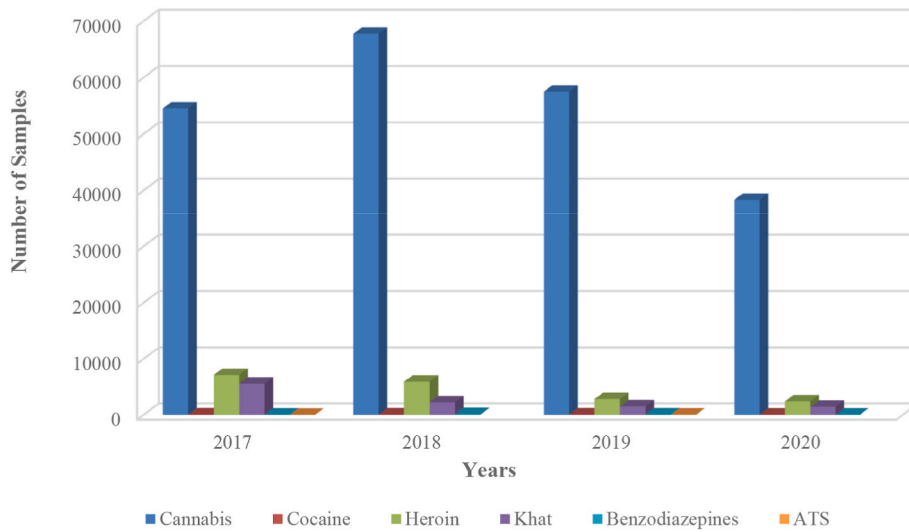


Fig. 2. Sample distribution of illegal substances confiscated between 2017 and 2020.

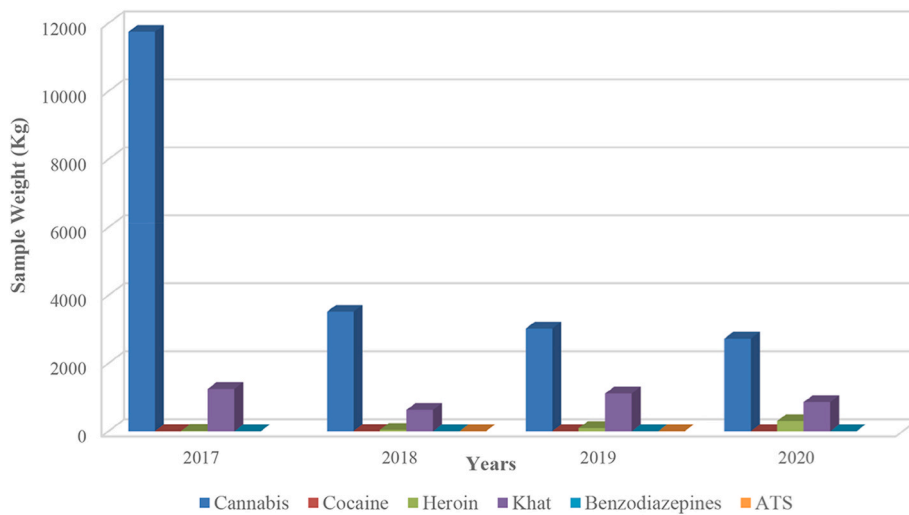


Fig. 3. Weights of illegal substances seized between 2017 and 2020.

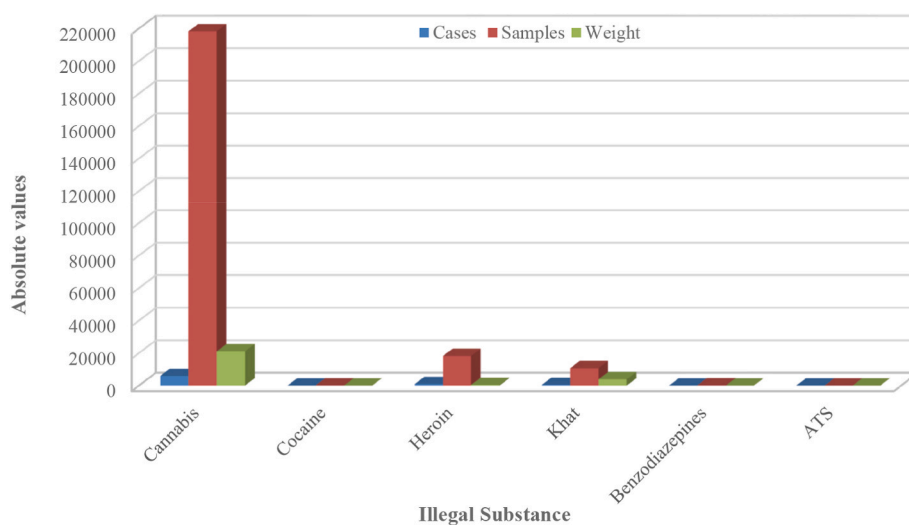


Fig. 4. Comparison of incidents, samples, and weight of illegal substances confiscated between 2017 and 2020.

Cocaine seizures rose to 5.9 kg in 2018 from 1.6 kg in 2017, then fell to 0.1 kg in 2020. The minimal cocaine seizures are due to the fact that Tanzania is not a major transnational cocaine trade hub, and cocaine is instead obtained in exchange for heroin or imported by air from South America.

Apart from an increase in both incidents and samples from 2017 to 2020, there was a progressive drop in the seizures of cannabis, cocaine, benzodiazepines, and ATS, although the weight of heroin increased from 2011 to 2016. In comparison to 2011–2016 [19], the weight of Khat confiscated decreased from 43.6% to 17.7% during 2017–2020. (Table 3; Fig. 3). The number of instances, samples, and weights of cocaine, benzodiazepines, and ATS were all under 10%.

A further indicator that the seizures were primarily from small local distributors and end users of drugs is the disparity between the weight of the illegal substances that were taken into custody and the increasing number of samples. A few milligrams to more than a ton were distributed across the weights of the seized samples. For instance, in 2017, a sizable quantity of marijuana was seized as a result of the interventions of farmers and traffickers. More than 90% of all seizures were made up of this sum, with the remaining 10% coming from small local distributors and end users. Most of the seizures in the subsequent years came from local distributors and drug users (Tables 1–3, Figs. 1–3). Apart from cannabis, the remaining illegal substances were primarily taken from end users and small local providers in tiny quantities. Table 4 and Fig. 4 compare the instances, samples, and weights of each prohibited substance that was confiscated. According to the proportion of weights to samples, the majority of the seizures came from small local suppliers and end users.

Tanzania plays a key role in the regional heroin trade, serving as a significant entrance point, transit point, and destination for heroin coming from Pakistan's west coast and Afghanistan via air routes and the Indian Ocean's east coast. Traffickers smuggle heroin to Europe and North America via small boats to Zanzibar and mainland Tanzania and overland borders with Kenya and Mozambique. On the other hand, Tanzania is not a major transnational cocaine trade centre, but it is frequently traded with heroin in the reverse direction [12–20]. Tanzania also serves as a transit country for methamphetamine en-route to other Asian countries and the Southern African market from Asia and neighboring Kenya. Precursor chemicals, mostly from Asian sources, are imported into ports and utilized to manufacture methamphetamine and psychotropic drugs in clandestine labs for domestic and international markets [5,22–25].

4. Conclusions

Overall, the weight of illegal substances seized declined considerably between 2017 and 2020, despite an increase in incidents and samples. The reduction in the weight of seizures from 13036.4 kg in 2017–3890.7 kg in 2020 demonstrates the government's extraordinary accomplishments in the fight against illicit drugs in the country. Roadblocks, the annihilation of cannabis plantations, joint efforts of law enforcement agencies, and both local and international and public participation to combat illicit drug production/importation, transit, and consumption have all played a vital role in the country's war against illicit drugs. As a result of the restrictions, inter-regional and cross-border drug transit has decreased. The decline of some of the semi-synthetic and synthetic illicit drugs is a good indicator of the government's efforts, initiatives, and increasing interceptions in the global war against illicit drug manufacture, transportation, distribution, and usage in partnership with international organizations. In general, the observed trend is inconsistent with the findings of the UNODC for the time period in question, which revealed a global drop in seizures. However, in the war against illicit substances, particularly heroin and locally produced cannabis and khat, greater efforts and involvement of local people are still required.

Despite the eruption of the COVID-19 pandemic near the end of

2019, which resulted in lockdowns and travel restrictions across borders, illicit drug markets around the world were mostly untouched due to the fact that illicit drug traffickers invented novel transportation, distribution, and delivery techniques. In Tanzania, a total of 303.5 kg of heroin was seized in 2020, the highest amount ever seized in a single year since the seizure of 248 kg in 2011 [19].

Declaration of competing interest

The author declares that there is no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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