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Purity Analysis of Heroin in Sri Lanka

Sandya Rajapakse KP*

Government Analysts Department, Senior Assistant Government Analyst, Isuru Mawatha Pelawatta, Battaramulla,n Sri Lanka.

***Corresponding author:** Sandya Rajapakse KP, Department of Government Analysts, Senior Assistant Government Analyst, Isuru Mawatha Pelawatta, Battaramulla, Sri Lanka, Tel: 94718262905, Email: sandyarajapakse@ymail.com

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Abstract

Heroin is the most abused narcotic drug in Sri Lanka. Drug samples seized by the Police, excise and custom enforcement officers are brought to the Government Analyst's Department for analysis as a requirement of judicial investigations. Purity analysis of these samples reveals the quality of the drug distributed island wide. The statistical evaluation with regard to availability of the types of narcotic drugs in Sri Lanka and purity variations of heroin samples received in the year 2018 and 2019 will be discussed in this paper.

Methods: Samples received to the laboratory in 2018 and 2019 were analyzed qualitatively and quantitatively using TLC, GCMS and GCFID respectively.

Results: Results revealed that there is marked variation of the pure heroin content with the gross weight of the sample. Most of samples received showed very low percentage of heroin.

Conclusion: Prison overcrowding is a severe problem in Sri Lanka. Most of the imprisonments are due to heroin related cases. These evidence showing the relationship between the gross weight and net weight of heroin cases can be used to amend the national drug policies in order to expedite the drug cases in the courts and tackle the drug phenomenon effectively in the country.

Keywords: Heroin, Purity Analysis, Illicit drugs

Introduction

Drug abuse is one of the prominent problems which affects the country in many aspects including social, economic, educational and health.

Usually drug is a chemical substance that brings beneficial effects for the human. However, due to the abuse usage, the same drug can be counted under the word "illicit drugs." Illicit drugs are substances that either stimulate (cocaine or methamphetamine) or inhibit (heroin, sedative hypnotics) the central nervous system or cause hallucinogenic effects (marijuana or LSD) to the effect that their use has been prohibited.

Government Analyst's Department is the only state owned forensic science laboratory in Sri Lanka which performs the analysis of illicit drugs receiving from all over the island as a requirement of judicial investigations. There is a remarkable increase in the number of drug cases received to the Narcotic laboratory in the past few years. As far as the total number of annual cases is concerned there is a trend of increasing the number of cases submitted every year. For instance the number of cases increased from 10782 in 2017 to 14643 in 2018.

Heroin is the most abused drug in Sri Lanka after cannabis. It is semisynthetic substance which is synthesized by acetylating morphine derived from opium [1]. Heroin (diacetyl morphine) was first produced in 1874 by a British chemist in the search for a non-addictive morphine substitute [2].

In this paper an investigation on heroin quality variations in Sri Lankan society will be presented by analyzing samples received to the GAD from island wide police stations, Police Narcotic Bureau and excise Department during the period 2018 and 2019.

The goal was to assess drug quality variations in the local market to investigate quality differences with respect to the gross weight of the samples seized by the law enforcement officers and thus to provide reliable evidence based information for decision makers to update and apply appropriate changes to national drug policies. As far as the pure heroin quantity of the samples with respect to their gross weight is concerned, criteria for bail can be amended as a solution to prison overcrowding, by considering the fact, if the gross weight is low, most of the cases have very low pure heroin quantity with milligram level.

Material and Methods

Drug sample collection

Seized drug samples were received from police, police Narcotic Bureau and Excise for routine analysis. Qualitative analysis was performed by preliminary test using marquis reagent, Thin layer Chromatography and GC-MS. For cases with more than 10 samples hypergeometric method was used to ascertain the number of samples needed to be analyzed [3].

Chemicals and reagents

All the chemicals and solvents used were Analar grade. Chloroform was purchased from Sisco research laboratory, India Methanol was purchased from VWR PROLABO chemicals, France. Internal standard for Heroin 2,2,2 triphenylacetophenone(benzopinacolone) was purchased from sigma Aldrich. Certified Reference Standard (CRM) of Heroin hydrochloride (99.98%) was obtained from the Lipomed Company Arlesheim, Switzerland, through UNODC Vienna, Austria.

Identification of Heroin

For the identification of Heroin presumptive test is carried out, and is often performed by using the marquis test where a reagent of sulfuric acid: 37% formaldehyde 9:1 mixture is used which gives a purple colour, when opiates are present [4].

Thin layer Chromatography

In forensic analysis, thin layer chromatography (TLC) is a distinctive, simple and useful method for drug analysis. A number of different solvent systems are available for this. In this analysis solvent system cyclohexane chloroform: diethyl amine (50:40:10) was used. Acidified Iodoplatinate reagent was used as the spray reagent. Thin Layer Chromatography is performed at the time of receiving the samples in order to check whether they contain dangerous drugs.

Qualitative analysis using GCMS

An Agilent 7890 A series gas chromatograph coupled to an Agilent 5795C inert XL MSD with Triple – Axis Detector with an auto injector and an Agilent 7693 Auto sampler were used to generate all standard and sample chromatograms. The MS detector was linked to a data handling system with Agilent chemstation integration software for data acquisition and storage. The column of 30m x 250µmx 0.25µm HP 5MS 5% phenyl methyl si-

loxane, was used with Helium (99.999%) ultra-high purity as the carrier gas at a flow rate of 0.6 ml/min and samples were injected in split less mode.

About 10 mg of the sample was weighed into a 10ml volumetric flask and dissolved in methanol. A volume of 1µl was injected in to the GCMS system for analysis.

The front inlet temperature was 280^{0}C. Chromatographic separation was achieved by keeping the initial oven temperature at 90^{0}C for 2 minutes and varying the oven temperature from 90^{0}C to 300^{0}C at a rate of 14^{0}C /min. The final temperature was held for 10 minutes. Total run time for sample was 27 minutes. The solvent delay was 3 minutes. Identification was performed using retention time and against MS database, comparing with the mass fragmentation pattern in the MS database and also with standard heroin.

Quantification of heroin with GC-FID

Approximately 10mg of each sample was weighed exactly into a volumetric flask and dissolved in the internal standard, betabenzo pinacolone (2,2,2 triphenyl aceto phenone) solution in chloroform with 0.6% of methanol and vortex for 1 minute and filled up to the mark. Then filtered through 0.45µm filters to a sample vial and injected in to a GC-FID systems.

Gas Chromatography separation was achieved by using Thermo scientific Trace 1300 GC system with flame ionization detector, auto sampler with chromeleon software. The column 5% phenyl methyl siloxane, 325^{0}C thermo HP5 (30.0mx0.25 mmx0.25µm). The injector temperature was setup at 250^{0}C and the detector temperature at 300^{0}C. Initial oven temperature at 200^{0}C and the temperature was increased at a ramp 30^{0}C/min to 280^{0}C for 9 minutes. Nitrogen was used as a carrier gas at a flow rate of 1.5 ml/min. Standard reference material of heroin was used to construct a calibration curve. A five-point calibration curve was established by injecting 1µl from 200ppm 400ppm, 600ppm, 800ppm and 1000 ppm of heroin standard solutions. Narcotic Laboratory of GAD participates inter laboratory comparison test conducted by UNODC, Vienna twice a year.

Calibration acceptance criteria for heroin was, $r^2 \geq 0.995$. The LOD and LOQ was determined by using the calculation, mean + 10SD, [standard deviation] and mean + 10SD respectively.

According to the Validation results of the GC-FID method, the limit of detection (LOD) and limit of quantification (LOQ) of heroin were 4.5 ppm and 6.5 ppm respectively. Ten replicates were analyzed and RSD was calculated to evaluate the precision. The method showed acceptable accuracies (% bias) of 1.6% and precision (%RSD) of less than 2%.

Results and Discussion

Statistical Data Analysis

Total number of Heroin containing samples received to the laboratory during 2018 was 11895 and in 2019 was 10390. They were categorized according to their gross weight as less than 2 grams, 2-5 grams, 5-10 grams, 10-200 grams and >200grams.

Number of Heroin cases received according to the gross weight is given in table 1 and Figure 1.

Gross weight	No of cases in 2018	No of cases in 2019
<2g	8138	6604
2-5	2801	2982
5-10	425	331
10-200	466	394
>200	65	79

Table 1: Number of Heroin cases received according to the gross weight

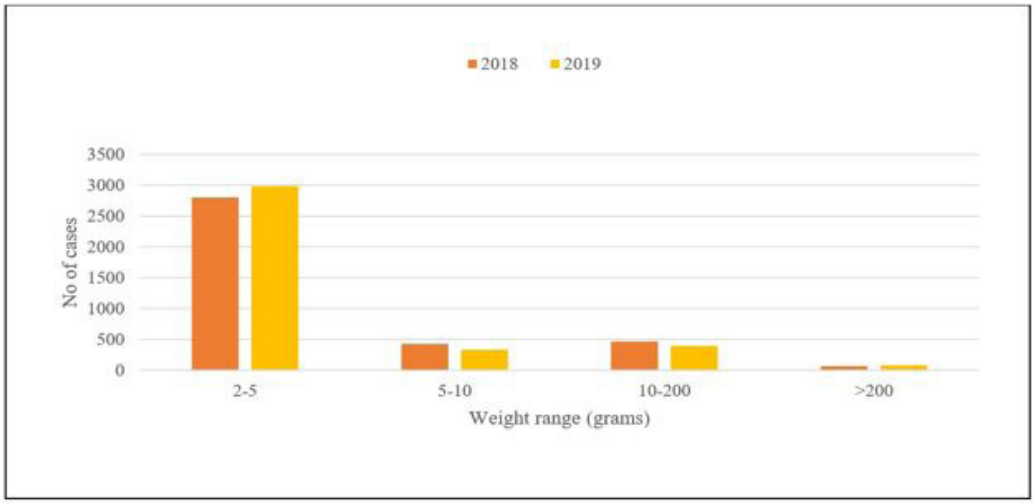

Figure 1: Number of Heroin cases received according to the gross weight

The statistical evaluation with respect to pure heroin quantity was performed only on samples having gross weight more 2 grams.

In 2018 a total of 3757 heroin cases were analyzed having the gross weight more than 2 grams and in 2019 a total of 3786 such heroin cases were analyzed.

A summary of the quantification results of the samples is given in Table 2 and Figure 2 .

Pure heroin Quantity	2018 No of samples (%)		2019 No of sample (%)	
<500mg	2596	(69.10%)	2735	(72.24%)
500mg - 1g	355	(9.4%)	303	(8.0%)
1g - 2g	302	(8.1%)	275	(7.3%)
2g - 5g	186	(5.0%)	149	(3.9%)
>5g	275	(7.3%)	257	(6.8%)
NEGATIVE	43	(1.1%)	67	(1.8%)

Table 2: Quantification results of the sample

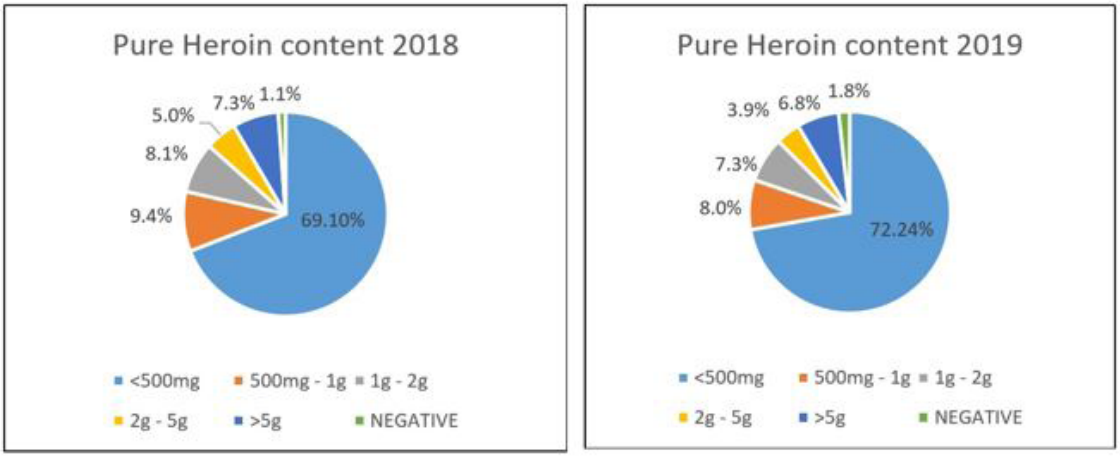

Figure 2: Quantification results of the samples

The overall heroin concentration varied from 0.1% to 92.8% in 2018 and 0.1% to 99.6% in 2019. Mean, median and minimum heroin concentrations were highest in >200g gross weight samples and lowest in 2-5g gross weight samples.

Variation of purity of heroin against the gross weight is given in Table (3) Figure (3)

Range of Pure Heroin Quantity	Number of Cases having gross weight 2 – 5g	Number of Cases having gross weight 5 - 10g	Number of Cases having gross weight 10 -200g	Number of Cases having gross weight Over 200g
<500mg	2390	165	40	1
500mg - 1g	221	92	40	2
1g - 2g	119	102	81	0
2g - 5g	35	50	101	0
>5g	0	16	200	59
NEGATIVE	36	0	4	3

Table 3: Variation of Pure Heroin Quantity with respect to the Gross Weight – 2018

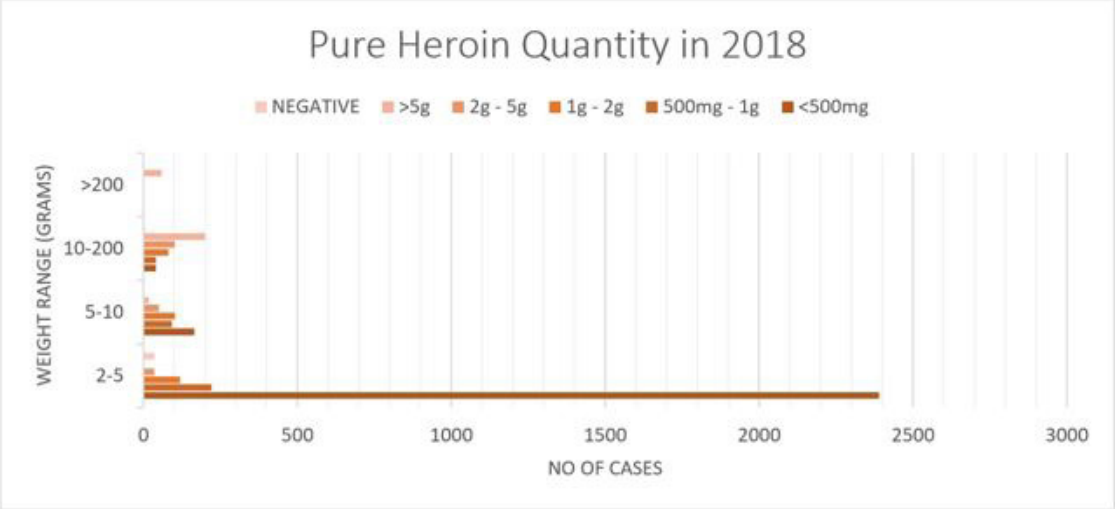

Figure 3: Variation of Pure Heroin Quantity with respect to the Gross Weight – 2018

In 2018 and Table (4) Figure (4) in 2019.

Range of Pure Heroin Quantity	Number of Cases having gross weight 2 - 5g	Number of Cases having gross weight 5 - 10g	Number of Cases having gross weight 10 -200g	Number of Cases having gross weight Over 200g
<500mg	2564	139	32	0
500mg - 1g	190	75	38	0
1g - 2g	144	65	66	0
2g - 5g	29	42	74	4
>5g	0	6	177	74
NEGATIVE	55	4	7	1

Table 4: Variation of Pure Heroin Quantity with respect to the Gross Weight – 2019

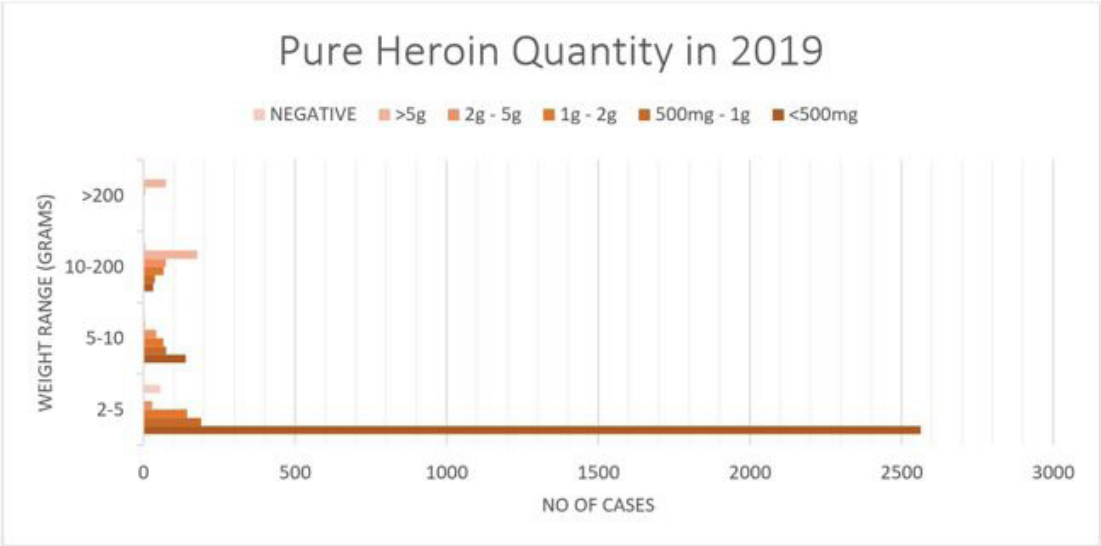

Figure 4: Variation of Pure Heroin Quantity with respect to the Gross Weight - 2019

The relation between the mass of the sample and the dosage of heroin is presumptuously caused by dilution inside the country. The main diluent identified in heroin street samples was acetaminophen, [Paracetamol]. Caffeine is a characteristic common adulterant in South West Asian type heroin. Most of the bulk samples analyzed contained caffeine as a adulterant and it was clear indication that those samples are coming from South West Asian origin.

The results revealed that, when the gross weight of the sample is low (2-5 g) most of the cases (85%) have the pure heroin quantity less than 500 milligrams and may be corresponding to the products, sold by small level dealers and consumed by end users. Gross weight (5-10g) cases only 3% cases have >5g pure heroin quantity. For higher gross weight quantities eg: (10-200g) 44% cases have >5g pure heroin quantity. Further cases having more than 200g gross weight, 92% cases have pure heroin quantity >5g. Those cases include large scale detections by Police Narcotic Bureau, police or Navy officers at the airport or transporting by boats or vessels at the sea

Conclusion

Prison overcrowding is a severe problem in Sri Lanka. When considering the main types of offences for prison admissions, drug related imprisonments, mainly heroin cases have accounted for the highest percentage. According to Sri Lankan Law death penalty or life imprisonment is given for cases having more than 2 grams of pure heroin quantity [5]. These evidences related to gross weight and net weight of heroin cases can be used for criminal justice ruling, drafting of, national drug policies and awareness campaigns. Further these results of the data collection will provide the evidence that policy makers and professionals need in order to tackle the drug phenomenon effectively.

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