

SUMMARY

This report details investigations into the use of 'Drink Detective' for detection of common date rape drugs. 'Drink Detective' is composed of three tests, the G test (for GHB), the K test (for ketamine) and the B test (for benzodiazepines, e.g. Rohypnol[®]). Drug controls, undoped and doped drinks were tested to evaluate detection limits for each test (in doped controls and alcoholic/non-alcoholic drinks), and to identify undoped/doped drinks that result in false positive/negative results, respectively. Results were compared to data quoted on the 'Drink Detective' insert.

The Drink Detective results were generally in line with the results described in the product insert. GHB, ketamine and Rohypnol[®] controls showed G, K and B test detection limits in the ranges 0.84-1.12 g/250 mL, 25-50 mg/250 mL, and 0.01-0.025 mg/250 mL, respectively (quoted detection limits are 1 g/250 mL, 125 mg/250 mL, and 0.125 mg/250 mL, respectively). False positive results for undoped drinks were observed with semi-skimmed milk and tea and coffee containing milk (G test), Bailey's (K test), and tonic water (K test).

GHB doped Reef could be detected down to a concentration in the range 0.84-1.12 g/250 mL. GHB doped white wine, Boddingtons draught bitter, brandy, Glenfiddich cask strength whisky, and apple juice could be detected down to 1.12 g/250 mL. Grand Marnier orange liqueur, Bacardi Breezer (watermelon), Bacardi Breezer (orange and vanilla), pineapple juice, tomato juice, orange juice, and coca cola could be detected down to 1.12-1.68 g/250 mL. The insert quoted 1.5 g/250 mL as the detection limit for many drinks. Red wine, Smirnoff spiced vanilla vodka and ribena could be detected down to 1.68-3.32 g/250 mL. GHB doped sherry was the only drink tested that gave a false negative response at 3.32 g/250 mL.

Ketamine doped Bacardi Breezer could be detected down to 50-100 mg/250 mL. Ketamine doped semi-skimmed milk was the only drink tested that gave a false negative response at a common dose (250 mg/250 mL).

Rohypnol[®] doped Reef (red berry and kiwi) could be detected down to 0.50-0.75

mg/250 mL. Rohypnol[®] doped Boddingtons draught bitter, brandy, Bacardi Breezer (watermelon), tomato juice, coca cola, semi-skimmed milk, and tea and coffee (with and without milk) could be detected down to 0.25 mg/250 mL. All other Rohypnol[®] doped tested drinks (except Glenfiddich cask strength whisky, 51% v/v alcohol) could be detected at 1.00 mg/250 mL (i.e. 1 Rohypnol[®] tablet in a 250 mL drink, which is a more realistic doping level since it is unlikely that anyone would put less than 1 tablet (containing 1 mg of Rohypnol[®]) into someone's drink). Rohypnol[®] doped Glenfiddich cask strength whisky could be detected at 1.50 mg/250 mL (which is within expected doping levels since spirits are dispensed in much smaller volumes, e.g. 1 Rohypnol[®] tablet in 25 & 50 mL measures equates to 10 & 5 mg/250 mL, respectively). The type of drink and its alcohol content clearly has a significant effect on the response of the B test.

For example, an alcohol concentration of 20% v/v or above gives rise to a false negative response at a Rohypnol[®] concentration of 0.1 mg/250 mL.

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1 INTRODUCTION

1.1 DRUG RAPE

‘Drug rape’ can be defined as sexual assault facilitated by use of furtively placed substances, usually sedatives, into drinks for the purpose of physically incapacitating the victim so that they are unable to consent to, or withstand sexual activity or other propositions. The three most common ‘drug rape’ drugs are gamma-hydroxybutyrate (GHB), ketamine, and benzodiazepines (benzos), which are rapid acting sedatives/euphoriants (Figure 1 in the appendices). Drugs used for such purposes are traceable in victim’s blood or urine for only a few hours after ingestion. Victims often do not seek help until days after the assault, partly because such drugs frequently produce amnesia, so the victim is unable to recall details of the attack, and partly because of their inability to recognise the signs of sexual assault. Such factors make proving these crimes difficult, and therefore very few result in criminal charges and prosecution.

There is also increased evidence that drink spiking is on the increase, with a recent report stating that one in four women in some regions report symptoms at some time or other.

1.1.1 Gamma-hydroxybutyrate (GHB)

GHB is a sedative-hypnotic that was developed as a sleep-aid. At low doses it has a euphoric effect similar to alcohol producing feelings of happiness and relaxation. Higher doses cause drowsiness, dizziness, nausea, and visual disturbances. High doses cause vomiting, muscle spasms, unconsciousness, seizures, severe respiratory depression, coma and death. The effects are usually felt between ten minutes and one hour after ingestion. The primary effects last about 2-3 hours, but residual effects can last up to a whole day. GHB is used in ‘drug rape’ since it renders the victim

incapable of resisting, and causes memory problems, and mental/physical paralysis. These effects are intensified in combination with alcohol. GHB is produced very easily using gamma-butyrolactone (GBL) and sodium hydroxide (Figure 1 in the appendices).

1.1.2 Ketamine

Ketamine (Ketalar[®]) is an intravenously and intramuscularly delivered rapid acting surgical dissociative (separating perception from sensation) anaesthetic and analgesic. The dosage for diagnostic manoeuvres and procedures not involving intense pain is usually 4 mg/kg, and doses of 6.5-13 mg/kg by intramuscular injection are used for short surgical procedures (10 mg/kg usually produces 12-25 minutes of surgical anaesthesia). When absorbed in a drink, the onset of effects is in 5 to 20 minutes and a duration of 4 to 6 hours. 24-48 hours are generally required to feel completely normal.

At lower doses ketamine results in a mild, dreamy, floating feeling. Higher doses produce a hallucinogenic effect, and may cause the user to feel an out-of-body/near-death experience. This experience is often referred to as entering a 'K-hole' (100 mg is usually enough to enter a K-hole). Physical effects include numbness, loss of coordination, muscle rigidity, slurred or blocked speech, a blank stare, and depression of respiratory function (but not central nervous system function and cardiovascular function is maintained).

1.1.3 Benzodiazepines (Benzos)

Benzos are among the most widely prescribed drugs, being central nervous system depressants used for treatment of insomnia and anxiety. They include diazepam (Valium[®]) and flunitrazepam (Rohypnol[®]). Rohypnol[®] is more potent than Valium[®], and is used for short-term treatment of severe sleep disorders. Effects of

Rohypnol[®] begin within 15-20 minutes of administration and may last for > 12 hours (depending on dose). Victims may experience slowing of psychomotor performance, decreased blood pressure, muscle relaxation, sleepiness, and mental/physical paralysis. Anterograde amnesia, where events occurring during the time the drug was in effect are forgotten, can occur in combination with alcohol. Metabolites are detectable in urine for up to 72 hours after ingestion. Since 1999, Roche (the manufacturer) has inserted a blue dye into Rohypnol[®] tablets to make it more visible/detectable in drinks.

1.2 DRINK DETECTIVE

There was therefore a need (and potential demand) for a rapid and easy to use test that could be performed in the environments where drink spiking often occurs (e.g. in a bar or nightclub). ‘Drink Detective’ was therefore developed in order to highlight this increasing social problem and to potentially reduce its frequency, by providing the means to detect the presence of GHB, ketamine and benzos utilising a combination of technologies. ‘Drink Detective’ consists of two different chemically impregnated test papers, which are sensitive, by means of a colorimetric reaction, to GHB (G Test) and ketamine (K Test), respectively, and an immunoassay strip for the detection of benzos (B Test). The result takes less than 30 seconds and is easy to perform, requiring just five drops of a drink for all three tests (applied using the disposable pipette provided in each kit). Detailed information on the ‘Drink Detective’ (principles, use, interpretation of results, limitations, individual test performance characteristics, cross-reactivity, tested drinks and comparison with competitor’s products) is provided in the product technical insert (in the appendices of this report) and on the ‘Drink Detective’ website (www.drinkdetective.com).

1.2.1 G Test (for GHB)

The G Test is not specific for GHB, but is termed a presumptive test in that it detects changes to a drink indicating the drug is present. The illicit manufacture of the substance (the most important source of street drugs) involves high concentrations of sodium hydroxide (NaOH, Figure 1 in the appendices), rendering the final solution with an alkaline pH (> 7). Paper G contains a specially buffered pH indicator suitable for the pH range of the majority of beverages used adulterated with GHB at a commonly used dose. A positive test (alkali/GHB detected) will initiate an immediate colour change of the pink G Test paper to blue.

The quoted sensitivity (detection limit) for the G Test is 4 mg/ml (equivalent to 1 g of GHB solution in 250 mL of drink, which is sufficient to induce mild intoxication). This sensitivity will depend on both the pH of the drink and that of the GHB solution. Most drinks are acidic, however, some are close to neutral pH and could give a false positive result (e.g. milk-containing drinks).

1.2.2 K Test (for ketamine)

The K Test contains reagent, which is sensitive to secondary amines, including ketamine by a colorimetric reaction. Reaction with secondary amines produces a rapid red/orange coloured derivative. The quoted sensitivity (detection limit) for the K Test is 0.5 mg/mL (equivalent to 125 mg of ketamine in 250 mL of drink, which is sufficient to induce moderate intoxication). The K Test is suitable for testing the majority of drinks, however those with a heavy orange colour (e.g. orange flavoured drinks) can produce false positive reactions. The K test also detects a wide range of other drugs that could be slipped into drinks, including cocaine, scopolamine, ecstasy and speed. A comprehensive list is not provided so as not to educate the would-be drink spiker.

1.2.3 B Test (for benzos)

The B Test strip is a competitive immunoassay, which produces two coloured lines for a negative result (no benzos detected) and a single line for a positive result (benzos detected). The quoted sensitivity (detection limit) for the B Test is 0.5 µg/mL (equivalent to 0.125 mg of benzo in 250 mL of drink). The only drinks that are known to potentially interfere with the functioning of this test are high alcohol content drinks (i.e. spirits such as brandy, whisky, etc). Presumably this is due to alcohol denaturing enzymes/proteins involved in the B test. The Drink Detective B test will detect all the family of benzodiazepines, in which there are over 40 drugs.

2 SCIENTIFIC TECHNIQUES

2.1 DRUGS, TEST KITS & DRINKS

Chembiotech Laboratories obtained the materials detailed below for the investigations detailed in this report to be performed. GHB was prepared by mixing gamma-butyrolactone (GBL, 10 mL) with sodium hydroxide solution (5.128 g in 10 mL of deionised water). The reaction is detailed in Figure 1 (in the appendices). A range of alcoholic and non-alcoholic drinks was also obtained (as detailed in the appendices).

Chembiotech Code	Description	Quantity
SDL/01	GHB (Na salt)	~ 20 mL
SDL/02	Ketamine (Sigma)	~ 1 g
SDL/03	Rohypnol [®] (flunitrazepam, Roche)	26 tablets (each containing 1 mg)
SDL/04	'Drink Detective' testing kits	98 kits

2.2 DRUG SOLUTIONS (CONTROLS)

Aliquots of the GHB solution (SDL/01) were diluted 1:1, 1:10, 1:50, 1:100, 1:150 and 1:200 with deionised water and with aqueous vodka (to give an alcohol content of 5% v/v). A sodium hydroxide solution was also prepared that mimicked the GHB production (without the GBL, i.e. ~ 5 g of NaOH in 20 mL of deionised water)

and was diluted as above. The results of testing these solutions with the 'Drink Detective' are presented in Tables 1-3, respectively (in the appendices).

A solution of Ketamine (SDL/02, 2.4 mg/mL, 600 mg/250 mL) was prepared and diluted accordingly with deionised water and with aqueous vodka (to give an alcohol content of 5% v/v) to give solutions with ketamine concentrations of 600, 400, 250, 100, 75, 50 and 25 mg/250mL. The results of testing these solutions with the 'Drink Detective' are presented in Tables 4 and 5 (in the appendices).

A solution of Rohypnol[®] (SDL/03, 1 mg/L, 0.25 mg/250 mL) was prepared and diluted accordingly with deionised water and with aqueous vodka (to give an alcohol content of 5% v/v) to give solutions with Rohypnol[®] concentrations in the range of 0.01-1.00 mg/250mL. The results of testing these solutions with the 'Drink Detective' are presented in Tables 6 and 7 (in the appendices).

2.3 UNDOPED DRINKS

A wide range of undoped drinks were tested using the 'Drink detective' to determine if they gave false positive results in the G, K or B tests. The results of testing these alcoholic and non-alcoholic drinks with the 'Drink Detective' are presented in Tables 8 and 9, respectively (in the appendices).

2.4 DOPED DRINKS

Aliquots of the provided GHB solution (SDL/01) were diluted 1:40, 1:50, 1:100, 1:150 and 1:200 with Reef (red berry & kiwi) to give GHB concentrations of 4.13, 3.32, 1.68, 1.12 and 0.84 g/250 mL. The results of testing these solutions with the 'Drink Detective' are presented in Table 10 (in the appendices). Aliquots of selected alcoholic and non-alcoholic drinks (5, 10 & 15 mL) were doped with the provided GHB solution (SDL/01, 100 µL) to give GHB dilutions of 1:50, 1:100, and 1:150, and GHB concentrations of 3.32, 1.68 and 1.12 g/250 mL. respectively. The results of

testing these GHB doped alcoholic and non-alcoholic drinks with the 'Drink Detective' are presented in Tables 11 and 12, respectively (in the appendices).

Aliquots of a ketamine solution (20 mg/mL) were diluted with deionised water and Bacardi Breezer (orange & vanilla) to give ketamine concentrations of 500, 250, 100 and 50 mg/250 mL and a Bacardi Breezer content of 90% v/v. The results of testing these ketamine doped drinks with the 'Drink Detective' are presented in Table 13 (in the appendices). Aliquots of the ketamine solution (100 µL, 20 mg/mL in deionised water) were added to aliquots of selected alcoholic and non-alcoholic drinks (1.9 mL), i.e. a Ketamine doping level of 250 mg/250 mL. The results of testing these ketamine doped alcoholic and non-alcoholic drinks with the 'Drink Detective' are presented in Tables 14 and 15, respectively (in the appendices).

Aliquots of a Rohypnol[®] solution (10 mg/L) were diluted with deionised water and Reef (red berry & kiwi) to give Rohypnol[®] concentrations of 1.0, 0.75, 0.5, 0.375, 0.25 and 0.125 mg/250 mL. The results of testing these Rohypnol[®] containing solutions with the 'Drink Detective' are presented in Table 16 (in the appendices). The effect of increasing alcohol concentration on Rohypnol[®] detection (at 0.1 mg/250 mL) was also tested on solutions containing aqueous vodka (5-30% v/v). The results of testing these Rohypnol[®]/vodka containing solutions with the 'Drink Detective' are presented in Table 17 (in the appendices). Aliquots of Rohypnol[®] solutions (100 µL, 10, 40 & 60 mg/L in deionised water) were added to aliquots of selected alcoholic and non-alcoholic drinks (900 µL), to give Rohypnol[®] doping levels of 0.25, 1.00 and 1.50 mg/250 mL. The results of testing these Rohypnol[®] doped alcoholic and non-alcoholic drinks with the 'Drink Detective' are presented in Tables 18 and 19, respectively (in the appendices).

3 DATA & EVALUATION

3.1 DRUG CONTROLS

3.1.1 GHB

The GHB solution (SDL/01) was prepared using 10 mL of GBL in a total volume of 20 mL, which equates to 11.2 g of GBL (density = 1.12 g/mL; MW = 86.09 g/mol) and a GBL concentration of 0.56 g/mL. Assuming that all of the GBL is converted to GHB (which should readily occur under the alkaline conditions employed), this gives a GHB concentration of 0.68 g/mL (GHB MW = 104.1 g/mol) or a NaGHB concentration of 0.82 g/mL (NaGHB MW = 126.1 g/mol). The GHB concentrations (g/250 mL) quoted in Tables 1, 2 & 10 (in the appendices) were calculated from the dilution of the initial GHB solution (0.68 g/mL) as indicated.

The results of the 'Drink Detective' G test on the GHB controls in water and 5% v/v alcohol (diluted from 37.5% v/v vodka) are presented in Tables 1 and 2, respectively (in the appendices). GHB was detected by the G test at levels from 1.12-84.64 g/250 mL, and was not detected at a level of 0.84 g/250 mL (in deionised water, Table 1). This is in agreement with the quoted detection limit of the G test of 1g/250 mL (technical insert in the appendices).

Alcohol (5% v/v, Table 2) did not alter the observed detection limit of the G test (i.e. of the samples tested), but did generally result in a fainter blue colour being observed (compared with NaOH, Table 3). NaOH produced the type of blue colouration indicated in the example 'positive' picture on the 'Drink Detective' test kit, however all of the GHB solutions tested produced a fainter/more diffuse blue colouration (i.e. without the dark blue outer edge).

3.1.2 Ketamine

The results of the 'Drink Detective' K test on the ketamine controls in water and 5% v/v alcohol (diluted from 37.5% v/v vodka) are presented in Tables 4 and 5, respectively (in the appendices). Ketamine was detected by the K test at levels from 50-600 mg/250 mL, and was not detected at a level of 25 mg/250 mL (in deionised water, Table 4). This is a better sensitivity than the quoted detection limit of the K test of 125 mg/250 mL (technical insert in the appendices).

Alcohol (5% v/v) appeared to improve the observed detection limit of the K test, since the lowest ketamine concentration tested, 25 mg/250 mL, also gave a positive result (Table 5 in the appendices). The key observation in determining a positive test is the appearance of the orange ring/halo outside the white ring (see the example 'positive' picture for the K test on the 'Drink Detective' test kit), since the middle can all be white/yellow at lower ketamine concentrations. Time can also be a factor in development of the orange colouration. A negative result was determined as being the absence of orange colouration on the outside of the white ring. It is important not to flood the test region (i.e. by loading too much sample).

3.1.3 Rohypnol®

The results of the 'Drink Detective' B test on the Rohypnol® controls in water and 5% v/v alcohol (diluted from 37.5% v/v vodka) are presented in Tables 6 and 7, respectively (in the appendices). Rohypnol® was detected by the B test at levels from 0.025-1.000 mg/250 mL, and was not detected at a level of 0.010 mg/250 mL (in deionised water, Table 6). This is a better sensitivity than the quoted detection limit of the B test of 0.125 mg/250 mL (technical insert in the appendices).

Alcohol (5% v/v) did not appear to have any effect on the observed detection limit of the B test (Table 7 in the appendices).

3.2 UNDOPED DRINKS

The results of the 'Drink Detective' G, K and B tests on the selected undoped alcoholic and non-alcoholic drinks are presented in Tables 8 and 9, respectively (in the appendices). The only drink tested that gave a false positive test to the G test was semi-skimmed milk (and tea and coffee with milk). This had the highest pH of all of the tested drinks (pH ~ 6.6). The pH above which the G test produces a blue colouration is not quoted. Bailey's did not give the expected false positive, however, its high viscosity and fat content makes it a poor wetting agent.

The only drinks tested that gave a false positive test to the K test were Bailey's and tonic water. Tonic water gave an initial orange colour in the K test, which then rapidly disappeared. It is interesting to note that a reproducible false positive test to the B test (only 1 line observed) was obtained using what proved to be coca cola that was ~ 3 months beyond its expiry date. Retesting with new batches of coke and diet coke gave the reproducible negative results to the B test. Bailey's was too viscous to sufficiently wet the test area to provide enough liquid for the immunoassay to run. Lime cordial gave a negative B test result, however it should be noted that the first line was very faint.

3.3 DOPED DRINKS

3.3.1 GHB

The results of the 'Drink Detective' G tests on the GHB doped Reef are presented in Table 10 (in the appendices). GHB doping was detected at levels of 1.12-4.13 g/250 mL, and not at a level of 0.84 g/250 mL. This is the same as for the GHB controls (Tables 1 and 2 in the appendices) and is in agreement with the quoted detection limit of the G test of 1 g/250 mL (technical insert in the appendices). This also shows that a highly red coloured drink such as Reef (red berry and kiwi) does not interfere with the G test. The results of the 'Drink Detective' G tests on the selected

GHB doped alcoholic and non-alcoholic drinks are presented in Tables 11 and 12, respectively (in the appendices).

A number of the tested GHB doped drinks did not produce a positive response to the G test for a doping level of 1.12 g/250 mL (1:150), however this is in agreement with their detection limit data (technical insert in the appendices), which lists many drinks as having a GHB detection limit of 1.5 g/250 mL. Only 4 drinks also did not produce a positive response for a GHB doping level of 1.68 g/250 mL (1:100), namely red wine, sherry, Smirnoff spiced vanilla vodka and undiluted ribena, however, all (except sherry) produced a positive response when the GHB doping level was increased by a factor of two to 3.32 g/250 mL (1:50, Tables 11 and 12 in the appendices). According to the technical information (in the appendices), a GHB dose of 1.12 g/250 mL is a mild dose, 1.68 g/250 mL would be a mild to standard dose and 3.32 g/250 mL would be a standard to strong dose. Observed false negative responses cannot be attributed to pH effects, since coca cola (the tested drink with the lowest pH) gave positive G test results at both tested concentrations.

3.3.2 Ketamine

The results of the 'Drink Detective' K tests on the ketamine doped Bacardi Breezer are presented in Table 13 (in the appendices). Ketamine doping was detected at levels of 100-500 mg/250 mL, and not at a level of 50 mg/250 mL. This is a slightly higher detection limit than observed for the ketamine controls (25-50 mg/250 mL, Tables 1 and 2 in the appendices), but is still better than the quoted detection limit of the K test of 125 mg/250 mL (technical insert in the appendices). The orange colouration of the Bacardi Breezer did not appear to significantly affect the sensitivity of the K test. The results of the 'Drink Detective' K tests on the selected ketamine doped alcoholic and non-alcoholic drinks are presented in Tables 14 and 15, respectively (in the appendices). Only ketamine doped semi-skimmed milk gave a false negative result to the K test (no evidence of an orange ring/halo) at a ketamine

doping level of 250 mg/250 mL (a common dose according to the technical information included in the appendices). All of the doped orange/red coloured drinks, e.g. Reef, Bacardi Breezer, ribena, tomato juice and orange juice, could be detected.

3.3.3 Rohypnol[®]

The results of the 'Drink Detective' B tests on the Rohypnol[®] doped Reef are presented in Table 16 (in the appendices). Rohypnol[®] doping was not detected at levels of 0.5-0.125 mg/250 mL (two lines clearly observed in the B test). At higher doping concentrations (0.75 & 1.00 mg/250 mL) Rohypnol[®] was detected, however there was some evidence of a very, very faint first line in the B test, indicating that the Reef was having an effect on Rohypnol[®] detection in the B test. The effect of increasing alcohol concentration (from 5-30% v/v) on the detection of Rohypnol[®] in the B test was also investigated using aqueous vodka. The results presented in Table 17 (in the appendices) show that at alcohol concentrations of 20% v/v and above a potentially false negative response for a Rohypnol[®] dose of 0.1 mg/250 mL (which is easily detected at an alcohol content of 5% v/v, Table 7 in the appendices) is observed for the B test (although it should be noted that the first line is very, very faint).

The results of the 'Drink Detective' B tests on the selected Rohypnol[®] doped alcoholic and non-alcoholic drinks are presented in Tables 18 and 19, respectively (in the appendices). Rohypnol[®] doped Boddingtons draught bitter, brandy, Bacardi Breezer (watermelon), tomato juice, coca cola, semi-skimmed milk, and tea and coffee (with and without milk) could be detected down to 0.25 mg/250 mL. All other Rohypnol[®] doped tested drinks (except Glenfiddich cask strength whisky, 51% v/v alcohol) could be detected at 1.00 mg/250 mL (i.e. 1 Rohypnol[®] tablet in a 250 mL drink, which is a more realistic doping level since it is unlikely that anyone would put less than 1 tablet (containing 1 mg of Rohypnol[®]) into someone's drink). Rohypnol[®] doped Glenfiddich cask strength whisky could be detected at 1.50 mg/250 mL (which is within expected doping levels since spirits are dispensed in much smaller volumes,

e.g. 1 Rohypnol[®] tablet in 25 & 50 mL measures equates to 10 & 5 mg/250 mL, respectively). The type of drink and its alcohol content clearly has a significant effect on the response of the B test.

4 CONCLUSIONS

- GHB controls (in water & 5% v/v alcohol) showed a G test detection limit between 0.84 and 1.12 g/250 mL (quoted: 1 g/250 mL).
- Ketamine controls (in water & 5% v/v alcohol) showed a K test detection limit between 25 and 50 mg/250 mL (quoted 125 mg/250 mL).
- Rohypnol[®] controls (in water & 5% v/v alcohol) showed a B test detection limit between 0.01 and 0.025 mg/250 mL (quoted: 0.125 mg/250 mL).
- False positive results for undoped drinks were only observed with semi-skimmed milk (& tea/coffee with milk, G test), Bailey's (K test), and tonic water (K test).
- GHB doped Reef (red berry & kiwi) could be detected down to 0.84-1.12 g/250 mL (quoted: 1 g/250 mL). GHB doped white wine, Boddingtons draught bitter, brandy, Glenfiddich cask strength whisky, and apple juice could be detected down to 1.12 g/250 mL. GHB doped Grand Marnier orange liqueur, Bacardi Breezer (watermelon), Bacardi Breezer (orange and vanilla), pineapple juice, tomato juice, orange juice, and coca cola could be detected down to 1.12-1.68 g/250 mL. GHB doped red wine, vanilla vodka and ribena could be detected down to 1.68-3.32 g/250 mL. GHB doped sherry was the only drink not detected at 3.32 g/250 mL.
- Ketamine doped Bacardi Breezer (orange & vanilla) could be detected down to 50- 100 mg/250 mL (quoted: 125 g/250 mL). Only ketamine doped semi-skimmed milk gave a false negative K test response at a ketamine dose of 250 mg/250 mL.
- Rohypnol[®] doped Reef (red berry & kiwi) could be detected by the B test down to 0.50-0.75 mg/250 mL. An alcohol concentration of 20% v/v or above gives a false negative response in the B test at a Rohypnol[®] concentration of 0.1 mg/250 mL.
- Rohypnol[®] doped Boddingtons bitter, brandy, Bacardi Breezer (watermelon),

tomato juice, coca cola, semi-skimmed milk (& tea/coffee with and without milk) could be detected down to 0.25 mg/250 mL. All other Rohypnol[®] doped tested drinks (except Glenfiddich whisky) could be detected at 1.00 mg/250 mL. Rohypnol[®] doped Glenfiddich whisky could be detected at 1.50 mg/250 mL.

5 APPENDICES

Drink Detective: Drinks Test Device Technical Insert (supplied by SureScreen).

- Figure 1.** Production of GHB from GBL & structures of ketamine and flunitrazepam.
- Table 1.** GHB diluted with deionised water.
- Table 2.** GHB diluted with aqueous vodka (to give an alcohol content of 5 % v/v).
- Table 3.** Sodium hydroxide (i.e. without GBL) diluted with deionised water.
- Table 4.** Ketamine dissolved in deionised water.
- Table 5.** Ketamine dissolved in aqueous vodka (to give an alcohol content of 5 % v/v).
- Table 6.** Rohypnol tablets dissolved in deionised water.
- Table 7.** Rohypnol tablets dissolved in aqueous vodka (to give an alcohol content of 5 % v/v).
- Table 8.** Testing of undoped alcoholic drinks.
- Table 9.** Testing of undoped non-alcoholic drinks.
- Table 10.** Reef doped with GHB (concentration study).
- Table 11.** Alcoholic drinks doped with GHB.
- Table 12.** Non-alcoholic drinks doped with GHB.
- Table 13.** Bacardi Breezer (O & V) doped with Ketamine (concentration study).
- Table 14.** Alcoholic drinks doped with Ketamine.
- Table 15.** Non-alcoholic drinks doped with Ketamine.
- Table 16.** Reef doped with Rohypnol (concentration study).
- Table 17.** Deionised water doped with Rohypnol (control).
- Table 18.** Effect of alcohol concentration on Rohypnol detection in the B test.
- Table 19.** Alcoholic drinks doped with Rohypnol.
- Table 20.** Non-alcoholic drinks doped with Rohypnol.