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Short communication

The presence of gamma-hydroxybutyric acid (GHB) and gamma-butyrolactone (GBL) in alcoholic and non-alcoholic beverages

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Abstract

Gamma-hydroxybutyric acid (GHB) and its precursor gamma-butyrolactone (GBL) are regularly implicated in instances of surreptitious drug administration, particularly in beverages (so-called ''spiked drinks''). In order to assist in the interpretation of cases where analysis of the actual beverage is required, over 50 beverages purchased in the UK were analysed for the presence of GHB and GBL. It was found that naturally occurring GHB and GBL were detected in those beverages involving the fermentation of white and particularly red grapes. No GHB or GBL was detected in other drinks such as beer, juice, spirits or liqueurs. GHB/GBL was detected in red wine vermouth (8.2 mg/L), sherry (9.7 mg/L), port (GBL), red wine (4.1–21.4 mg/L) and white wine (<3–9.6 mg/L). The presence of GHB/GBL did not appear to be influenced by the alcohol content or the pH of the beverage. In addition, the concentration in wines did not appear to be related to the geographical origin of the grape type. This is believed to be the first published data concerning the endogenous presence of GHB and GBL in the beverages described.

Keywords: Gamma-hydroxybutyric acid; Gamma-butyrolactone; Beverages

1. Introduction

Gamma-hydroxybutyric acid (GHB), also known as ''Liquid Ecstasy'' has been implicated in many cases of suspected surreptitious administration, potentially for the purpose of increasing victim vulnerability to sexual assault [1]. Due to the rapid dissolving properties of GHB powder resulting in a colourless solution when in water, the perceived route of administration is typically associated with the adulteration of a victim's beverage. The precursor solvent gamma-butyrolactone (GBL) may be used as an alternative as it is rapidly converted to GHB in the body [2]. The use of these compounds in this way can be a very dangerous practice as the exact concentration of the resultant solution is largely unknown and may result in serious and potentially fatal GHB intoxication. This would particularly be the case if the ''spiked'' beverage was alcoholic or if the victim was/had been drinking alcohol prior to the incident. Following an accusation of suspected ''spiked drink'', as part of the investigation and if available, the actual beverage may be analysed to determine the presence of drugs (e.g. GHB). The necessary dose of GHB to produce incapacitation or even disinhibition (approximately >2 g) would be associated with high concentrations in beverages due to the relatively small liquid volume of most drinks. Nonetheless, it would be necessary to be aware of any naturally occurring GHB or GBL in the beverage. GHB is believed to be present in ripe fruits and meat and Collison et al. recently presented data

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from the United States for various beverages and foodstuffs [3,4]. It was found that GHB was present at its highest concentration in red (2.00–23.00 mg/L) and white wine (0.65–9.53 mg/L), followed by vinegars (0.83–11.25 mg/L), soy sauce (2.79–18.10 mg/L), liqueurs (<0.25–4.20 mg/L), various non-distilled drinks (1.88–6.68 mg/L), beer (<0.25–2.10 mg/L) and coffee (0.52–2.09 mg/L). No GHB was detected (<0.50 mg/L) in any of the distilled alcoholic drinks (e.g. whisky) or juices tested (except grape juice). There are currently no available or published data regarding specific concentrations in alcoholic and non-alcoholic beverages commercially available in the UK.

Another aspect of the necessity of information relating to the natural presence of GHB in drinks involves the increasing availability of alleged detection kits for drugs (including GHB) in beverages. These products are marketed for individuals to be able to ''test'' their drink to determine whether a drug has been added. Apart from the immediate flaws in the process (i.e. only detect a limited number of compounds), additional problems include: (i) it may be ''negative'' at the time of testing but may require continual testing, (ii) the chemistry involved in detection may lead to false positive/negative results and (iii) the lack of any immediate confirmation [5,6]. It is also conceivable that depending on the nature or sensitivity of the assay, the presence of certain residual/endogenous compounds may also lead to false positive findings. The possibility of false positive or negative results could have important medical, social and legal ramifications. Therefore, there is both a forensic and public requirement for data concerning the presence of compounds, in particular GHB, in alcoholic and non-alcoholic beverages. This short communication presents novel data from a study of over 50 beverages purchased within the UK.

2. Materials and methods

Beverages were obtained from various licensed premises and stores. In some cases multiple products/brands were analysed of the same drink group (e.g. lager). A 5 mL aliquot of each beverage was retained and stored at 4 °C prior to analysis (typically analysed within 3 days following collection). Samples were initially analysed using gas chromato-

Table 1
Presence of GHB/GBL in various beverages

Beverage	Alcohol content (%, v/v)	GHB concentration (mg/L)	GBL detected? (LOD = 5 mg/L)
Aftershock blue	40	ND	No
Amaretto	28	ND	No
Bitter	4	ND	No
Cream liqueur	17	ND	No
Bourbon	40	ND	No
Brandy	40	ND	No
Cider	5.5	ND	No
Drambuie	40	ND	No
Gin	40	ND	No
Red wine vermouth	17	8.2	Yes
Dark rum	40	ND	No
White rum	37.5	ND	No
Sherry	17.5	9.7	Yes
Vodka	37.5	ND	No
Vodka + juice	5	ND	No
Vodka schnapps	4.4	ND	No
Whisky	40	ND	No
Cranberry juice	None	ND	No
Grapefruit juice	None	ND	No
Orange juice	None	ND	No
Pineapple juice	None	ND	No
Tomato juice	None	ND	No
Tonic water	None	ND	No
Tequila	38	ND	No
Absinthe	70	ND	No
Lager	4	ND	No
Port	20	ND	Yes
Red grape juice	None	ND	No
White grape juice	None	ND	No
Red wine	12–14	4.1–21.4 (mean 12.6)	Yes
White wine	9.5–13.5	<3–9.6 (mean 5.7)	Yes

LOD: limit of detection; ND: not detected (GHB limit of detection = 3 mg/L).