Alcohol gel ingestion amongst homeless Eastern and Central Europeans in London: assessing the effects on cognitive functioning and psychological health

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GLOSSARY

Alcohol gel: hand sanitizer/antiseptic liquid gel, often found in hospitals and intended to be used as a supplement to hand washing.

Cognition: a set of mental actions and/or thought processes related to knowledge, attention, memory, reasoning, language production, decision making etc.

Digit Span: the longest list of digits that an individual can repeat back in correct order, immediately after presentation (digit span forward). Backward digit span involves the recall of items in reverse order.

Executive functioning: a term which encompasses the management (regulation, control) of higher order cognitive processes, such as working memory, task flexibility, decision marking and problem solving.

Frontal Lobes: one of the four main brain areas/lobes located at the fore front of the brains cerebral hemisphere, involved in motor control and cognitive activities.

Prospective memory (PM): remembering to do something at some point in the future

Retrospective memory (RM): the learning retention and retrieval of events, words and people encountered or experienced in the past

Verbal working memory: the mental capacity to be able to temporarily, hold, store and manipulate information in order to decide which information is needed to achieve a goal or solve a problem. It can be assessed with Digit Span. Some researchers use this term interchangeably with Short-term memory (STM) when specifically referring to Digit span forward (DSF)

Visuo-spatial abilities*: the ability to understand and conceptualize visual

representations and their spatial relationships in learning and performing a task

ABSTRACT

Background: Intentional consumption of alcohol based hand gels has been reported especially amongst non-UK national, alcohol dependent, homeless individuals in London. Whilst alcohol misuse is known to be associated with impaired cognitive functioning and mental health problems, the effects of additional ingestion of alcohol gel are unknown. **Objectives:** To explore cognitive and psychological functioning in users who intentionally ingest alcohol gel compared with ethyl-alcohol only misusers and controls. **Methods:** Male, Central and Eastern European alcohol only misusers, (n=14; mean age 39 years), alcohol gel users (n=14; mean age 43 years) and controls (n=12; mean age 31 years) were recruited from a London Homeless Service during 2013/14. Alcohol misusers, alcohol gel users and controls were compared on the Forwards and Backwards Digit Span Test; Block Design test; Retrospective and Prospective Memory Questionnaire (PRMQ) and the Hospital and Anxiety Depression Scale (HADS).
Results: Alcohol gel users performed significantly worse on the Block Design task (p<0.01) and PRMQ (p<0.01) relative to both alcohol only and control groups, and significantly worse on the digit span relative to controls (p=0.01). Both alcohol misusing groups scored comparatively on digit span backwards (p<0.01), with both groups performing significantly worse than controls. The alcohol gel group reported significantly higher levels of anxiety relative to controls (p=0.02). **Conclusions:** Whilst there could be constitutional differences between alcohol misusers who additionally abuse alcohol gel, the findings suggest that alcohol gel ingestion may have a greater impact on psychological functioning than traditional alcohol misuse.

INTRODUCTION

Alcohol-based hand sanitizers (hereafter referred to as 'alcohol gel') are a well known alternative to soap and water for effective hand hygiene across a range of settings. Whilst not intended for ingestion, there is a small chance of toxicity from accidental (unintentional) ingestion of alcohol gels as evidenced mainly in children (e.g. Engel and Spiller, 2010) and a high chance of toxicity from intentional ingestion and abuse (Doyon and Welsh, 2007; Emadi and Coberly, 2007; Thanarajasingam et al, 2007; Archer et al, 2007).   In the US, Gormley et al (2012) identified 14 cases of intentional alcohol gel ingestion (with one death) over a 4 year period, with an increased rate of 6 per year. In the UK, the number of adult ingestion related inquires rose by 314%, from 7 up to 29, during two 16 month periods in 2003-2005 and 2005-2006, with 66% (19) thought to be intentional ingestion (Archer et al 2007).   In most cases those who reported intentional consumption of alcohol gel also reported mental illness, substance or alcohol abuse (Gormley et al, 2012; Archer et al, 2007).

Alcohol gels contain 60-70% of one or more alcohols, including ethanol, isopropanol or n-propanol or sometimes a combination (Bessonneau, Clement and Thomas, 2010; Boyce and Pittet, 2002). In Europe 60% isopropanol is the standard ingredient in alcohol-based gels, but n-propanol is also found (WHO, 2009).   Given the different alcohols and combinations in these gels, as well as a wide variation in individual response and tolerance to alcohol, a toxic dose is hard to determine. Toxic effects have however been observed in those who intentionally ingest 500ml, although as little as 360ml containing 80% ethanol could have severe toxic effects (Archer et al, 2007).

However, relative to a standard beverage of ethyl alcohol, isopropanol is considered more toxic; for example, it is two to three times more potent as a central nervous system (CNS) depressant at comparable doses (Dhillon and von Burg, 1995). As such, whilst effects include altered mental status similar to those of ethyl alcohol intoxication (e.g., headache, dizziness, in-coordination, hypoglycaemia, abdominal pain, nausea, vomiting, and haematemesis), isopropanol is likely to induce CNS effects requiring medical intervention e.g. myocardinal function, respiratory arrest, hypotension and coma (Winchester et al, 1998). Isopropanol alcohol is also thought to be metabolized at a much slower rate than ethyl alcohol and is mostly metabolized into acetone, which in itself causes CNS depression and symptoms identical to isopropanol alcohol, thus contributing to the potential long-term toxic effects of isopropanol alcohol (Daniel, McAnalley and Garriott, 1981).

The harmful neuroanatomical effects on the brain of chronic ethyl alcohol consumption (alcohol misuse and dependence) are now well established (e.g. Chanraud et al, 2007; Sullivan, Harris and Pfefferbaum, 2010). Subsequent psychological and cognitive effects are also well documented, with 50-80% of patients showing signs of cognitive impairment (Bernardin et al, 2014). The primary cognitive function most susceptible to alcohol misuse, and which appears irreversible is executive functioning (Norton and Halay, 2011; Bernardin et al, 2014). This includes processes such as decision making, mental flexibility, divided attention, working memory (both verbal and non-verbal) and inhibitory control (e.g. Noel et al, 2009; Sullivan, Harris and Pfefferbaum, 2010; Wollenweber et al, 2014). In addition, visuo-spatial abilities are also impaired (e.g.

memory and visual learning, visuospatial organisation, visuospatial processing; Oscar-Berman and Marinkovic, 2007; Ratti et al 2002) and more recent evidence documents prospective memory deficits (PM; remembering to do something at some point in the future Griffiths et al, 2012), which along with retrospective memory (RM; the learning retention and retrieval of events, words and people encountered or experienced in the past (Smith et al, 2000; Soderlund et al, 2007) has also been shown to be disrupted in chronic and/or excessive alcohol users (Heffernan, 2008).   In addition to cognitive functioning, chronic exposure to ethyl-alcohol has also been frequently associated with mental health problems such as anxiety and depression (e.g. Uekermann et al, 2003; Boden and Fergusson, 2011).

Whilst the literature on the psychological and cognitive effects of chronic exposure to alcohol in the form of ethyl alcohol has thus been well established, this has mainly focused on chronic and/or heavy alcohol abusers, who consume ethyl alcohol in the traditional format of alcoholic drinks. To date no research has been published about the potential effect of alcohol ingested in the form of gel, on such behaviors. Given that the most common constitute of alcohol rubs in the UK - isopropanol, is considered more toxic than ethanol, the consequences of alcohol gel ingestion warrants investigation.

Over the last couple of years, anecdotal reports suggest intentional alcohol gel use has been increasing in the London homeless population, particularly amongst those who are non UK nationals from Central and Eastern Europe (particularly Polish, Romanians, Lithuanians and Czech Republicans; Homeless Link, 2008; Thames Reach, 2012).   In

all cases those intentionally ingesting alcohol gel appear to be heavily dependent on

ethyl alcohol (The Journal, 2011). Reports of people stealing the alcohol gel from local

hospitals and pouring it into bottles of water or soft drinks and mixing it with sugar have

also been documented (Thames Reach, 2012). Particular problems for homeless non

UK nationals with alcohol support needs include the high cost of alcohol and difficulties

accessing detoxification and rehabilitation programmes due to limited access to the

social welfare system. This may exacerbate their alcohol addiction (Garapich, 2011)

and tendency to steal and consume alcohol gels (The Journal, 2011), potentially further

compounding the problem, especially if such usage is associated with additional

problems over and above ethyl alcohol use alone.

The aim of the current study was therefore to compare cognitive performance in areas

which have been shown to be impaired by chronic alcohol exposure (working memory,

visuo-spatial abilities, RM and PM memory), in a group of homeless male ethyl alcohol

and alcohol gel misusers (alcohol gel users), relative to homeless ethyl alcohol

misusers who do not ingest alcohol gel (alcohol only misusers) and non-alcohol abusing

homeless males (controls). Given that the most common constitute of alcohol gels in the

UK - isopropanol, is considered more toxic than ethanol, it was hypothesized that the

alcohol gel users would exhibit poorer cognitive performance relative to alcohol only

misusers, who in turn, would display lower cognitive performance relative to controls.

Secondly, given that chronic alcohol use is clearly associated with levels of anxiety and

depression (Schneier et al, 2010; Boden and Fergusson, 2011) the study also sought to

determine whether alcohol gel users displayed higher levels of anxiety and depression relative to alcohol only misusers and controls.

METHODS

Participants

Forty-five male participants (15 per group) were recruited from The Passage Day Centre, a homeless resource centre in London. Alcohol misusers were recruited as a result of being referred to the specialist substance misuse team following an initial assessment at the homeless centre. They were subsequently given a comprehensive drug and alcohol assessment; assessing drug usage, associated harms, treatment history and the Westminster Primary Alcohol Screening Tool for alcohol dependence (a modified brief version of the AUDIT). Both alcohol using groups ('alcohol only' and 'alcohol gel') were identified as alcohol dependent users who were being seen on a weekly basis by the specialist substance misuse team working towards addressing their dependency issues. Those recruited to the control group accessed the centre for other reasons (e.g. training and welfare), but were not identified as having alcohol related needs.

All participants were of Central and Eastern European nationality, the majority were Polish (51%), followed by Romanian (21%). Two participants who had previously been diagnosed with epilepsy and 5 who self-reported brain damage were excluded from

subsequent analyses resulting in 14 participants who reported misusing ethyl alcohol as well as ingesting alcohol gel ('alcohol gel'; mean age 43.21 [SD= 10.05] years), 14 participants who reported misusing ethyl alcohol only ('alcohol only'; mean age 39.43 [SD=10.10] years) and a control group (n=12) reporting no substance use, other than nicotine ('control'; mean age 31.42 [SD=10.68]). The alcohol gel group were significantly older than the control group (p=0.02).

Participants were required to abstain from all substances for a minimum of 12 hours prior to assessment (based on clinical observation; no urine or breath tests were used). All participants gave written informed consent and the study was approved by the University of East London's (UEL) School of Psychology Ethics Committee.

Assessment Measures

Participants were assessed on the following measures, in the order presented below, in a quiet meeting room at the Passage Day Centre. The assessment process lasted up to 1 hour.

Alcohol Use Disorders Identification Test (AUDIT; Saunders et al, 1993): The AUDIT is a reliable and valid self-report measure to assess harmful and hazardous drinking, including abuse and dependence in the last 12 months, in a range of cultural groups (Dawe et al, 2002). It consists of 10-items e.g. 'How often do you have a drink containing alcohol. Participants circle the response that applies to them e.g. 'never' to

'4 or more times a week'. Items are scored 0-4 or for items 9 and 10; 0, 2 or 4. A total score of 8 or above has been used to indicate alcohol problems; a score of 13 or more is likely to indicate alcohol dependence. Reliability as measured by Cronbachs alpha in this current sample was 0.75.

Alcohol Gel Questionnaire (AGQ): Adapted specifically for this study, the wording of the AUDIT was adjusted to measure hazardous and harmful consumption of alcohol gel e.g. 'How often do you have a drink containing alcohol gel'. An additional item was included to assess duration of alcohol gel use, thus the questionnaire consisted of 11 items. Response format and scoring were the same as the AUDIT, with the exception of the additional item where participants were asked to indicate how long they had been using alcohol gel (Five options: <1 month, 2-4 months, 4-6, 6-12 or 1+ years). Reliability as measured by Cronbachs alpha in this current sample was 0.80.

The Hospital and Anxiety and Depression Scale (HADS) (Zigmond and Snaith, 1983): The HADS is a 14-item validated scale (Zigmond and Snaith, 1983) with good internal consistency (Moorey et al., 1991) which provides a brief measure of both anxiety (seven items; e.g. 'I feel tense or wound up') and depression (seven items; e.g. 'I still enjoy things I used to enjoy'). Participants indicate one of four options which best applies to them for each e.g. 'Most of the time', 'A lot of the time', 'From time to time, Occasionally', 'Not at all'. Responses are scored from 0-3, with separate total scores for anxiety and depression, each ranging from 0 to 21; a higher score indicates more severe symptomatology. Scores between 8-10 indicate clinical symptoms and 11+

indicates 'probable clinical disorders'. Reliability as measured by Cronbachs alpha in this current sample was 0.72 for the depression subscale and 0.80 for the anxiety subscale.

The Prospective and Retrospective Memory Questionnaire (PRMQ) (Smith et al 2000):
The PRMQ is a measure of everyday prospective memory (PM) and retrospective memory (RM) performance. It is valid and reliable measure amongst healthy individuals or clinical patients reporting diminished cognitive abilities (Kliegel and Jager, 2006). This 16-item scale consists of eight items concerning PM failures, e.g. "Do you decide to do something in a few minutes time and then forget to do it?", and eight concerning RM failures, e.g. "Do you fail to recognize a place you have visited before?" Participants circle the correct response that applies to them from a 5 point scale: 5 (very often) to 1 (never), resulting in minimum and maximum possible total scores of 16 and 80 respectively. A higher score indicates poorer memory. Reliability as measured by Cronbachs alpha in this current sample was 0.92.

Digit Span task: A sub-test of the Wechsler Adult Intelligence Scale – Third edition (WAIS –III; Wechsler, 1997) was used to assess verbal working memory. It is composed of two tasks administered independently, Digit Span Forwards (DSF) and Digit Span Backwards (DSB). A series of pairs of number sequences that gradually increase in length is read to the participant for them to repeat back, either in the same, (DSF) or reverse order (DSB). Each pair is scored 0, 1, or 2 points; 2 points when both sequences of a trial are passed, 1 point when only one sequence of a trial is passed

and 0 points with fail on both sequences. The total score (DST) is calculated by adding together the scores of the 2 tasks.

Block Design Task: A subtest of the Wechsler Adult Intelligence Scale – Third edition (WAIS-III; Wechsler, 1997) was used to assess participants' visuo-spatial abilities. Participants are presented with models of pictures of two- colour designs and asked to replicate them using blocks with each block having two white sides, and two half- red and half- white sides. The designs progress in difficulty from simple two block designs to more complex, nine block designs. For the first 6 designs, participants are given two attempts to replicate the correct design. The attempts are scored with 2 points when a design is replicated on the first attempt, 1 point when this is replicated on the second attempt and 0 points in cases where both attempts fail. For designs 7-14 participants are only given 1 attempt to obtain a minimum of 4 points for successful completion of the design within the time limit. On the basis of the completion time, the participants can earn 1 - 3 bonus points for quick, perfect performance. Scores range from 0 to 68 with higher scores indicating better performance.

Data Analysis

All data was processed and analysed using the Statistical Package for Social Science (SPSS) version 20 in Windows Vista. Given that there were significant age differences between groups, raw data for the WAIS III Block Design and DST were converted to scaled scores based on age (Wechsler, 1997) and analyses were conducted and

presented on these scaled scores. PRM has not been shown to be influenced by age and therefore age adjusted scores are not available nor necessary (Crawford et al, 2003), thus raw data was used. All cognitive and psychological health data were analysed using ANOVA using the conventional 5% value for statistical significance. Bonferroni pairwise post hoc comparisons were used on all significant group effects to identify specific group differences, with the adjusted alpha of 0.017. Independent t-tests were used on AUDIT data only to determine differences in alcohol dependence / use between the two alcohol using groups (alcohol only and alcohol gel).

RESULTS

Alcohol dependence

Alcohol gel users reported a mean (SD) AUDIT score of 27.07 (7.77); the mean (SD) for alcohol only misusers was 22.14 (8.71). According to the AUDIT cut off levels (Saunders et al, 1993), group means indicate that both alcohol gel users and alcohol only misusers were alcohol dependent (>13). There was no significant difference in alcohol dependence as measured by the AUDIT between alcohol only and alcohol gel misusers; t (26) = 1.58, p=0.13.

Utilising the same scoring and cut off guidelines as the AUDIT, the AGQ indicates levels of dependence to alcohol gel amongst this group, with a mean (SD) of 22.5 (9.52). 36%

of alcohol gel users reported using alcohol gel on a monthly basis, 29% reported using 2 - 4 times a month and 21% reported using 4 or more times a week. A majority (50%) of the alcohol gel users reported using 1-2 drinks containing alcohol gel on a typical day of usage, 14% consumed 3 - 4 drinks, and 38% reported using over 10 drinks in this form on a typical day. 29% reported using alcohol gel for less than a month, 21% reported using it for 4-6 months and 50% reported using alcohol gel for over a year.

Psychological Health

There were no significant group differences on levels of depression $F_{(2,37)}$ = 2.36, p=0.11, but there was a significant group difference for anxiety; $F_{(2, 37)}$ =4.24, p = 0.02, with the alcohol gel group reporting higher levels of anxiety compared to the controls (p=0.04). See table 1.

[TABLE 1 HERE]

Cognitive Data (see table 1)

Block Design: There was a statistically significant group effect on block design performance; $F_{(2,37)}$=7.21, p<0.01. Alcohol gel users showed poorer performance compared to both the alcohol only (p=0.01) and control group (p<0.01).

Digit Span: There was a significant group difference on DST performance, $F_{(2,37)}$= 5.03, p=0.01. Controls performing significantly better than alcohol gel (p=0.01). There were no significant group differences on DSF, $F_{(2, 37)}$ = 1.89, p= 0.17, despite both alcohol groups appearing to perform worse than controls. There was a significant group effect on DSB, $F_{(2, 41)}$ = 10.13, p < 0.01 with controls performing significantly better than both the alcohol gel (p<0.01) and the alcohol only (p<0.01) groups.

Prospective and Retrospective Memory: PM scores differed significantly between groups, $F_{(2, 37)}$ = 11.77, p<0.01 with the alcohol gel group reporting worse PM than both the alcohol only (p<0.01) and control group (p<0.01). There was also a statistically significant group difference on RM scores, $F_{(2, 37)}$ = 10.84, p<0.01. Again alcohol gel users reported significantly worse memory than both the alcohol only (p<0.01) and control (p<0.01) groups.

DISCUSSION

Chronic consumption of traditional alcohol has well-established detrimental, and sometimes, irreversible effects on cognition. Given that the main constitute of alcohol gels (isopropanol) is considered more toxic than ethyl alcohol, the current study tested the prediction that intentional alcohol gel ingestion would be associated with poorer cognitive performance and inferior psychological health.

Alcohol gel users performed worse on a majority of measures (all except depression and DSF), compared with the control group, and worse on some measures compared with alcohol only misusers, indicating poorer cognitive performance and psychological health. In particular, alcohol gel users performed significantly worse on visuo-spatial abilities (as measured by the Block Design test), reported greater retrospective and prospective memory deficits (as measured by the PRMQ) and poorer verbal working memory (as measured by the DST). In addition, both alcohol using groups ('alcohol gel' and 'alcohol only') demonstrated poorer performance (scoring significantly lower) on digit span backwards, but not DSF, relative to controls. This may reflect differential cognitive susceptibility of these tasks to ethyl alcohol, with the DSB being a more demanding task drawing on working memory rather than simple verbal recall (DSF). In addition, relative to the control group, alcohol gel users also reported elevated levels of anxiety.

Chronic alcohol use and dependency is associated with impaired cognitive functioning particularly working memory, visuospatial abilities and prospective memory, as well as with mental health problems (Norton and Halay, 2011; Bernardin et al, 2014; Sullivan et al, 2000; Fox et al, 2000; Oscar-Berman and Marinkovic, 2007; Ratti et al 2002; Griffiths et al, 2012). That alcohol gel users also display poorer performance in these areas is therefore consistent with this previous research. In some areas, cognitive functions, namely visuo-spatial abilities and retro- and prospective memory, were worse than in alcohol only misusers, despite very similar alcohol dependence levels (as measured by the AUDIT) tentatively suggesting that the consumption of alcohol hand gel may be

associated with a more marked profile of cognitive deficits than ethyl alcohol although this requires replication.

Although others report visuo-spatial deficits in alcohol abusers (Berman et al, 1997; Fox et al, 2000); here alcohol only misusers and controls performed similarly. This is consistent with Kokavec and Crowe (1999), who also failed to find visuo-spatial deficits in chronic alcohol misusers. In the present study, although the alcohol only misusers performed worse than the controls, the lack of statistical significance could be attributed to the fact that the control group; a matched group of homeless individuals, may also be exhibiting cognitive dysfunction which masks any deficits in the alcohol only group. Indeed, previous research consistently report global cognitive deficits in homeless populations (Spence et al, 2004; Pluck et al, 2012), even after controlling for alcohol and/or drug use (Cotman and Sandman, 1997).

The fact that alcohol gel users in the current study report elevated levels of anxiety relative to controls supports the well-established link between alcohol abuse/dependence and anxiety (Schneier et al, 2010; Boden and Fergusson, 2011). Anxiety scores (11+) indicate probably clinical disorders (Zigmond and Snaith, 1983), but the clinical relevance for this group of vulnerable users needs to be fully established. Given that the alcohol only group didn't differ from controls, it is possible that the additional use of alcohol gel is the cause of greater psychological symptoms and may indeed account for the impaired cognitive performance. Alternatively, higher levels of anxiety might predispose individuals to use alternative forms of alcohol, such as gel.

This is the first known study to assess the cognitive and psychological profiles amongst a specific homeless population of individuals who ingest alcohol gel. The data suggests that the additional use of alcohol gel could result in cognitive deficits and anxiety symptoms over and above the use of ethyl alcohol only. Given comparable scores on the AUDIT amongst the alcohol using groups, these cognitive and psychological differences do not appear to be simply due to differences in levels of alcohol dependence and may be because the content of alcohol gels (mainly isopropanol in these cases) is more toxic than ethanol (Dhillon and von Burg, 1995). Nevertheless, it is also possible that there is something qualitatively different about individuals who choose to consume alcohol gel; such as psychological backgrounds, high anxiety levels or pre-existing cognitive deficits which could lead to increased likelihood of alcohol gel consumption. The fact that these alcohol gels pose serious physical health risks including damage to the stomach lining may imply that relative to alcohol only users, these individuals "*either don't know or are too desperate to care about the risks*" (Thames Reach, 2012), could support this.

Whilst the present study is the first to suggest alcohol gel ingestion, relative to alcohol misuse alone, is associated with additional problems, there are alternative factors and limitations of the current study which need to be considered. Firstly, alcohol gel users were significantly older than controls; whilst efforts were taken to account for this by using scaled scores which account for age, where available, this age difference could act as a potential confound in other assessed areas of function. Secondly, the sample

was a homeless population who traditionally display complex psychosocial problems; poor education levels, poor nutrition, mental illness, some or all of which may be associated with the decline in cognitive functioning in this sample (Pluck et al, 2012). Thirdly, as previous studies have also shown, IQ amongst the homeless varies between the low to average range (Spence et al, 2004; Pluck et al, 2012). As there was no measure of general intelligence in the current study one cannot definitively conclude that the performance impairments were solely due to the effects of alcohol gel. Indeed poorer cognitive capacity and reduced psychological functioning in the alcohol gel group might predate alcohol gel ingestion and enhance susceptibility to use, as noted earlier. Given that alcohol gel ingestion is reported only in the homeless at present, a large scale longitudinal study would be pragmatically difficult given the transient nature of this participant sample. Finally, the study focused solely on Central and Eastern European homeless participants; whilst we are not aware of the extent to which this is a problem in other cultures and the non-homeless population, this is something that should be a focus for future research, to gauge the scope of the problem.

Further limitations of the current study worth noting are the reliance on self-report questionnaire data for the assessment of retrospective and prospective memory, rather than a more objective test. Secondly, the alcohol gel questionnaire was developed specifically for this study, by adapting the AUDIT. Whilst Cronbachs reliability in this current sample was 0.8, its full reliability and validity has not been fully established. In addition, we cannot conclusively state that the participants had abstained from alcohol use for 12 hours prior to assessment, as there was no objective measure of abstinence

from alcohol, alcohol gel or indeed any other substance. However, an important strength of the study was the inclusion of both an alcohol only group and a control group, both of which comprised homeless participants from the same day centre and with the exception of age, the same socio-demographic background. This hasn't always been the case in published studies assessing cognitive dysfunction in homeless groups (Spence et al, 2004; Pluck et al, 2012).

In conclusion, this is the first known study to identify and assess the cognitive and psychological effects associated with alcohol gel ingestion in an alcohol misusing homeless population. Alcohol gel use was associated with poorer visuo-spatial and memory abilities relative to a comparable alcohol misusing group who did not report alcohol gel ingestion, and with higher levels of anxiety and poorer working memory relative to a non-alcohol misusing homeless control group. Given the increase in reported intentional ingestion of alcohol gel amongst homeless alcohol misusing individuals, the effects on physical and psychological health warrants further investigation. Determining the potential consequences of ingestion might help inform educational strategies, treatments and harm minimisation strategies for this group of users especially as those reporting its use are less able to access alcohol dependency services (Garapich, 2011).

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Table 1: Means and standard deviations by group (alcohol gel, alcohol only, control) for anxiety, depression, block design, digit span task, and retrospective & prospective memory scores.

	Alcohol Gel (G)		Alcohol only (A)		Controls (C)		P	Post hoc *
	M	SD	M	SD	M	SD		
Anxiety	11.07	4.56	7.72	4.36	6.92	2.81	0.02	G>C
Depression	9.14	4.34	7.71	3.73	5.83	3.43	0.11	-
Block Design #	6.86	2.51	9.36	2.17	9.83	1.75	<0.01	G<A & C
Digit Span Total#	5.71	2.43	6.29	1.77	8.17	1.80	0.01	G<C
Digit Span Forwards	6.57	1.83	7.00	1.75	7.83	1.34	0.12	-
Digit Span Backwards	3.71	2.02	4.43	1.55	6.75	1.71	<0.01	C>G & A
Prospective Memory	24.64	5.61	17.64	4.47	15.33	5.37	<0.01	G>A &C
Retrospective Memory	23.71	4.27	17.29	3.63	14.92	6.96	<0.01	G>A &C

* all p's < 0.05

scaled scores - individual raw data were converted to scaled scores based on age (Wechsler, 1997)