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Alcohol Health Literacy in Young Adults with Type 1 Diabetes and Impact on Diabetes Management

Running heading: Alcohol Health Literacy in T1DM

By

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Novelty statement (100 words max):

- The study identifies the extent of low alcohol health literacy in young adults with Type 1 diabetes, with less than 10% of participants able to identify the alcohol and carbohydrate content accurately in more than half of commonly consumed drinks.
- Alcohol consumption amongst participants was common with almost a third of women (32.9%) and over a fifth of men (22.6%) engaged in increased risk drinking.
- Strategies to minimise alcohol-associated risk were inconsistent and so young adults are at increased risk for diabetes mis-management when consuming alcohol.

Abstract:

Aims: Alcohol-specific health literacy is poor in the general population and this is also likely to apply to young adults with type 1 diabetes (T1DM). Alcohol directly affects glycaemic control and accurate estimation of alcohol intake can support effective diabetes management. Little is known about alcohol knowledge accuracy and management strategies of young adults with T1DM when consuming alcohol. The study investigated knowledge of alcohol and carbohydrate content of commonly consumed beverages among young adults with T1DM and explored alcohol consumption while identifying diabetes self-management strategies for minimising alcohol-associated risk.

Method: An open-access, multiple-choice web-survey investigating knowledge of alcohol and carbohydrate content of typical alcoholic drinks using images. Participants also recorded current alcohol consumption and diabetes self-management strategies when drinking.

Results: 547 participants aged 18-30 years participated (341 women; 192 men; mean age 24.5 SD 3.7 years), of whom 365 (66.7%) drank alcohol. 84 (32.9%) women and 31 (22.6%) men scored above **the cut-off** for increased risk drinking. Knowledge accuracy of alcohol units was poor: only 7.3% ($n=40$) correctly identified the alcohol content of ≥ 6 of ten drinks. Carbohydrate content was also poor: no participant correctly identified the carbohydrate content of ≥ 6 of ten drinks. Various and inconsistent strategies to minimise alcohol-associated risk were reported.

Conclusions: Alcohol consumption was common, however, knowledge of alcohol and carbohydrate content were poor. Greater alcohol related health literacy is required to minimize alcohol-associated risk. Further research should develop effective strategies to improve health literacy and support safe drinking for young adults with T1DM.

Introduction

In the UK, there is a drinking culture that particularly affects young adults, with binge drinking being a major problem within this age group. Over one in five young men (22%) and approximately one in six young women (17%) reported binge drinking in 2012¹, as the peer-based pursuit of drunkenness has become an integral part of the experience of young adulthood in the UK². Alcohol misuse is an important public health problem, accounting for more than 20,000 premature deaths per year in the UK. One in 16 hospital admissions are due to alcohol related illnesses¹ and alcohol is associated with up to 70% of all presentations to Accident and Emergency departments during busy periods³.

There is a significant health burden associated with alcohol consumption among young adults with T1DM with consumption common and potentially harmful. **Whilst specific data on alcohol consumption for this population are unavailable**, prevalence estimates vary widely⁴. Social and cultural norms make drinking alcohol socially acceptable, and this behaviour is widely experienced and seen as 'normal' in this age group, including people with diabetes⁵. Furthermore, there is likely to be an underestimation of drinking level in clinical studies, owing to under-reporting by participants who may fear the consequences of disclosure⁶. Given the integral social context of alcohol consumption, it is unsurprising that young adults with T1DM drink alcohol frequently and often. Excessive drinking **for any individual is ill-advised and contrary to medical advice for those with T1DM⁵**.

The potential for, and severity of, harm associated with alcohol use is higher in people with diabetes than in the general population. In addition to the range of physical, psychological and social harms experienced by the general population, there are specific effects of alcohol on diabetes and glycaemic control. Alcohol can directly affect glucose control through its effects on hepatic glucose output leading to glucose lability⁷, ketoacidosis⁸ and significant hypoglycaemia for up to 24 hours after drinking alcohol⁹. Poor understanding of how alcohol affects glycaemic control may contribute to inappropriate insulin adjustment or carbohydrate consumption when drinking, compounded by poor estimates of alcohol consumption and inaccurately recalled patterns of consumption.

While accurate knowledge of the alcoholic content of drinks is notoriously poor amongst all people within this age group¹⁰, it is a particular problem for people with

T1DM although there is a paucity of literature on alcohol knowledge in adults with T1DM. Alcohol intoxication may affect diabetes self-management through altered consciousness or dis-inhibition (e.g. forgetting or being unable to inject insulin or undertake appropriate self-monitoring of blood glucose), particularly with moderately heavy alcohol consumption¹¹. Glycaemic control may also be affected by other aspects of drinking, for example, some alcoholic drinks contain significant glucose with high glycaemic load, leading to hyperglycaemia in the first few hours of drinking.

Appropriate insulin bolus dosing requires an accurate estimation of the number of carbohydrates an individual is eating, with subsequent blood glucose control reflecting whether the correct amount of insulin was administered to cover a given amount of carbohydrates. Carbohydrates are found in drinks as well as food and so it is important to understand how much carbohydrate is being consumed when drinking in order to calculate a bolus insulin dose correctly.

The aim of this study was to determine the alcohol health literacy of young adults with T1DM, their understanding of the effect of alcohol on diabetes control and self-reported alcohol consumption.

Participants and Methods

Participants

Young adults with T1DM aged 18-30 years residing in the UK were invited to participate in the survey. Participants were volunteers recruited via the Diabetes Research Network, diabetes clinics and social networking sites such as Diabetes UK, Student Services, Facebook, Twitter, type 1 diabetes social networks and other diabetes forums used by young adults with T1DM. At participating diabetes centres, posters and flyers, with links to the survey, were presented to potential participants face-to-face and a social media campaign was launched using brief messages with the same links and promulgated via a network of followers.

Web-Survey

Following ethics approval from South Central Strategic Health Authority (ref 12/SC/0603), a web-survey, hosted on the University of Southampton website, incorporating a simple knowledge test assessing the accuracy of health literacy of alcohol drinks commonly consumed by young adults was utilised. Our methodology has been previously used and reported and was innovative, engaging and suitable

for an online survey¹². The survey was piloted for usability, relevance and ease of completion by healthcare professionals and potential participants from the Diabetes UK User Involvement Group. No modifications were required.

Measures included a 10 item alcohol knowledge 'quiz' using pictures of commonly consumed alcoholic drinks, questions assessing understanding of the impact of alcohol on glycaemic control; knowledge of insulin sensitivity factor and corrective action required; and strategies employed to minimise the risk of alcohol. The risk levels of alcohol use were assessed by the well-validated 3-item Alcohol Use Disorders Identification Test (AUDIT-C)¹³.

Statistical Analysis

The quantitative data were analysed using SPSS v21.0. All questions were multiple-choice or close-ended questions. Free text answers were analysed qualitatively using content and thematic analysis. Statistical analysis included **descriptive** analysis employed tables and crosstabs. Inferential tests included chi-square, Students' t test for independent groups and one way ANOVA. For continuous data that were not normally distributed the non parametric tests Mann Whitney and Spearman rank were employed. Statistical significance was defined as $p \leq 0.05$.

Results

Characteristics of the participants

1536 people registered and provided consent for the survey. 921 did not provide any answers and so were excluded. A further 68 were excluded because they did not meet the inclusion criteria (aged >30 years).

547 participants took the survey including 192 men (35.1%), 341 women (62.3%) and 14 (2.6%) participants who did not state their gender (Figure 1).

INSERT FIGURE 1 ABOUT HERE

The living status of the participants is shown in Table 1. Most participants did not have any dependent children ($n=476$, 89.6%); 36 (6.6%) had one child; 13 (2.4%) had two children and 6 (1.1%) had three or more children. Over a third of participants (35.2%) lived in London or the South East with distribution of all

participants broadly reflecting the population spread across England and Wales according to 2011 census data¹⁸.

INSERT TABLE 1 ABOUT HERE

Duration of diabetes was reported by 383 participants (70.0%) and ranged from one month to 28 years (mean 10.5, SD 6.4). Approximately half of participants ($n=297$, 54.3%) reported knowing their latest HbA_{1c} result. Reported HbA_{1c} results ranged from 29-144 mmol/l (4.8-15.3%), mean 63 mmol/l (7.9%), SD 17 mmol/l (1.6%).

392 (71.7%) participants reported their usual alcohol consumption of whom 365 (66.7% of respondents) drank alcohol. A similar proportion of participants of all age groups reported consuming alcohol but older participants drink >6 drinks at a time less frequently $p<0.001$). 84 (32.9%) women and 31 (22.6%) men reported an AUDIT-C score ≥ 4 and ≥ 6 respectively which is considered optimal for identifying people who are drinking at increased risk (table 2).

INSERT TABLE 2 ABOUT HERE

Alcohol and Carbohydrate Knowledge Accuracy

Alcohol knowledge accuracy was poor: only 7.3% ($n=40$) correctly identified the alcohol content of ≥ 6 of ten drinks included in the survey. Knowledge of carbohydrate content was also poor: no participant correctly identified the carbohydrate content of ≥ 6 of ten drinks. Worryingly 18.9% and 26.4% of participants failed to identify correctly the alcohol and carbohydrate content respectively in a single drink.

There was no difference in alcohol and carbohydrate knowledge accuracy between men and women or between those who took precautions when drinking compared with those who did not. Age and alcohol knowledge were not significantly correlated with knowledge.

There was little consistency regarding over- and under-estimation of alcohol and carbohydrate content of drinks. Participants over-estimated alcohol and carbohydrate content for seven out of ten drinks whilst under-estimating alcohol carbohydrate content of wine and lager. Several participants under-estimated the alcohol and carbohydrates in a glass of wine, but over-estimated both in a bottle of wine, perhaps reflecting confusion about how many 'glasses' are in a bottle of wine.

INSERT TABLE 3 ABOUT HERE

Precautions while drinking

364 (66.5%) participants reported taking precautions to allow them to drink safely while 25 (4.6%) reported not taking precautions. 158 (28.9%) did not answer. The reported precautions are detailed in Table 4.

INSERT TABLE 4 ABOUT HERE

Problems associated with Drinking

76 (13.9%) participants reported having confused the symptoms of a “hypo” with feeling drunk. 46 young adults (8.4%) had been admitted to hospital with either diabetic ketoacidosis or hypoglycaemia within the past twelve months. Of these, 6 (13%) reported their admission to be related to alcohol use.

Discussion

This survey has demonstrated **widespread** poor alcohol and carbohydrate health literacy among young adults with T1DM. **Only a minority of participants were** able to estimate the amount of alcohol and carbohydrate correctly in ≥ 6 out of ten different sample alcoholic drinks. A further 18.9% answered all questions incorrectly. The survey also highlighted a poor understanding of how alcohol affects glycaemic control as many participants did not take precautions while drinking and some of the reported precautions were potentially harmful or ineffective.

Previous research has highlighted the central role that alcohol plays in the social networks of young adults and the extent of alcohol consumption in this population. Whilst an earlier study has suggested that young adults with T1DM drink less alcohol than their peers¹³ this study indicated that a significant proportion of participants are consuming potentially dangerous levels of alcohol **and at similar levels to those in the general population¹².**

Alcohol can directly affect glucose control biomedically and by decreasing protective self-care behaviours whilst drinking. The degree to which this may occur is related to the amount consumed and so knowledge of the amount of alcohol and carbohydrate

being consumed is needed in order to allow the person with diabetes to adjust their insulin appropriately.

Health literacy is a broader concept than simply knowledge; however, without knowledge there cannot be the broader important aspects of functional and critical health literacy. This study is a first step in understanding and improving health literacy in this area and is reported as such. The study tests application of knowledge (an aspect of functional health literacy); i.e. through the calculation of units of alcohol and carbohydrate content from the information provided. How this knowledge is specifically used to manage blood glucose levels safely whilst consuming alcohol requires further exploration in future research.

The observed combination of high levels of alcohol consumption and low alcohol health and carbohydrate content literacy of alcoholic drinks poses a heightened risk for individuals with T1DM. Clinicians do not commonly discuss alcohol consumption and risk minimization in routine out-patient appointments and so young people seek information and advice elsewhere such as from social networking sites on the internet¹⁴. Previous research indicates that much of this information lacks medical evidence and is potentially dangerous. Resources are required to improve health literacy in this population and minimize alcohol-associated risks.

Accurate knowledge of the alcoholic content of drinks amongst young adults is notoriously poor¹⁰, however, it is a particular problem for people with T1DM because this inaccuracy and ignorance may contribute to potentially inappropriate diabetes self-management behaviours with serious consequences. The study demonstrated that a significant minority of participants had experienced harm as a result of drinking, including confusing signs of drunkenness and hypoglycaemia and admissions to hospital.

The strengths of this study include the interactive methodology and innovative recruitment strategy employed to access the target population across a wide geographic area. The study is limited because the survey was only available to people with internet access, although this is probably a significant proportion of the target group¹⁵. Similarly, ethnicity and social background data were not requested so it is not possible to know the proportion of participants from ethnic minorities or their social background. Furthermore, a large number of people, about whom we have no further information, consented but did not complete the survey. It is also impossible

to determine the integrity or honesty of responses. The alcoholic beverages included were carefully selected for their relevance to young adults, however, it is recognized that participants may drink a more limited choice of alcoholic beverages and so their knowledge may not extend to the whole selection. However, all the necessary information necessary to calculate alcohol content of each drink was provided so limited consumption should not have been a significant barrier to accuracy.

In order to develop appropriate interventions, a greater understanding of knowledge accuracy of alcohol and carbohydrate content of drinks and the impact of alcohol on diabetes control among young adults with T1DM is required. This information can then be used to inform future interventions to help young adults with T1DM minimize the risks associated with alcohol consumption and optimize their well-being and diabetes management.

The provision of better healthcare to young people with T1DM relies on an acceptance that alcohol use will occur as prohibition is unlikely to succeed. Clinicians should be able to provide accurate and supportive advice about lower risk drinking. Despite this need, there is a paucity of evidence on interventions to minimize the risks of alcohol⁵. Furthermore, most healthcare professionals receive no training in this under-appreciated health issue, despite recent NICE guidance CG115 on the treatment of alcohol dependence and harmful use that states: "Staff working in services provided and funded by the NHS who care for people who potentially misuse alcohol should be competent to identify harmful drinking"¹⁵.

Conclusion

Alcohol consumption was common amongst young adults with T1DM, reflecting the drinking culture amongst this age range. Knowledge of alcohol and carbohydrate content of beverages were poor. Greater alcohol related health literacy is required to minimize alcohol-associated risk for people who consume alcohol. Further research is required to develop effective strategies to improve health literacy and support safe drinking for young adults with T1DM.

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Conflicts of Interest

No relevant conflicts of interest were reported

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Tables

Table 1: Reported Living Status of Participants

Living Status	<i>N</i>	%
Living with parents	197	36.8
Living alone	44	8.2
Living in shared accommodation with friends	51	9.5
Married or living with a partner	176	32.9
Living away from home at university or college	60	11.2
Living away from home doing apprenticeship training	2	0.4
Working away from home	5	10.9
No answer	12	2.2

Table 2: Number of correct answers of the alcohol and carbohydrate content of the 10 drinks included in the survey

Number of Correct Answers	Alcohol <i>N</i>	Alcohol %	Carbs <i>N</i>	Carbs %
0	97	18.9	116	26.4
1	99	19.3	155	35.2
2	95	18.5	110	25.0
3	86	16.7	43	9.8
4	61	11.9	14	3.2
5	36	7.0	2	0.5
6	20	3.9	-	-
7	11	2.1	-	-
8	4	0.8	-	-
9	4	0.8	-	-
10	1	0.2	-	-
Total	514	100	440	100

Table 3: Precautions Taken for Safe Drinking

Precaution	N
Self-monitoring of blood glucose (incl. setting alarms for increasing SMBG during night)	308
Increase carbohydrate intake	251
Decrease carbohydrate intake	28
Increase insulin dose	103
Decrease insulin dose	176
Tell friends you have diabetes	325
Wear a medical alert bracelet or similar	158
Avoid alcohol	94
Avoid drinking on an empty stomach	302
Drinking in moderation or reduced drinking	36
Avoiding sugary drinks	19
Carrying rapid acting carbohydrate	16
Being selective about drinks including pre-drinking at home	7
Running blood glucose higher than usual	2
Taking paracetamol	2

Table 4: Audit Score

Score	Women		Men	
	N	% Total	N	% Total
0	18	4.6	10	2.6
1	44	11.2	5	1.3
2	51	13.0	17	4.3
3	58	14.8	22	5.6
4	42	10.7	29	7.4
5	14	3.6	23	5.9
6	20	5.1	17	4.3
7	4	1.0	3	0.8
8	3	0.8	5	1.3
9	1	0.3	6	1.5
Total	255	65.1	137	34.9

Shaded areas indicate those who are drinking at increased risk levels.

Figure Legends

Figure 1: Participant Recruitment Flowchart

Figure 2: Copy of Questions in Survey

Figure 1:

