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Comparison of self-reported alcohol use with the alcohol biomarker phosphatidylethanol among young people in northern Tanzania☆

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ABSTRACT

Background: The one-month Time Line Follow Back calendar (TLFB) and the Alcohol Use Disorders Identification Test (AUDIT) are used to collect self-reported alcohol intake data. We compared these instruments with the alcohol biomarker phosphatidylethanol (PEth) among young-people in northern Tanzania.
Methods: AUDIT and TLFB were applied in a cross-sectional study of 202 young people (18–24 years), who reported using alcohol during the past year (103 male casual labourers; 99 college students). We assayed whole blood for PEth 16:0/18:1, using liquid chromatography-tandem mass spectrometry.
Results: For both self-report methods, alcohol consumption was high, particularly among men (e.g. a median of 54 drinks per month in labourers), and about half of male students (48%) reported hazardous or harmful levels of drinking (AUDIT ≥8). Almost half (49%) of participants were PEth-positive (median concentration 0.03 μmol/L). There were significant positive correlations between reported total alcohol intake and PEth concentration in males (Spearman's correlation $r_s = 0.65$ in college students and $r_s = 0.57$ in casual labourers; $p < 0.001$). Self-reported use in the past month was a sensitive marker of having a positive PEth result (≥0.01 μmol/L) with 89% of those with a PEth positive result reporting alcohol use, and this was similar in all groups. The proportion of those with AUDIT scores ≥8 and AUDIT-C scores ≥6 among those with a high cut-off positive PEth result (≥0.30 μmol/L) ranged between 94 and 100%.
Conclusion: TLFB and AUDIT are sensitive measures to detect heavy alcohol use among young-people in northern Tanzania. They can be used to identify young people who may benefit from alcohol-focused interventions.

1. Introduction

Excessive alcohol use is a major public health problem, and is associated with an estimated 5% of global mortality and 6% of disability adjusted life year's (DALYs) lost globally (World Health Organisation, 2014). It often begins at a young age (Bellis et al., 2009; Gore et al., 2011; Swahn et al., 2010a, 2010b). According to WHO, 46% of the world's adolescents aged 15–19 years reported having ever used alcohol, and 34% had used it in the last year (World Health Organisation, 2014). In Africa, these estimates were 41% and 29%, respectively (World Health Organisation, 2014). The estimated prevalence of heavy episodic drinking (defined as intake of at least 6 standard alcoholic drinks on one occasion; World Health Organisation, 2014) is higher in adolescents than in adults in general populations (adolescents: 12% globally and 8% in Africa; adults: 8% globally and 6% in Africa; World Health Organisation, 2014).

A recent systematic review showed that alcohol use is also common among young people in eastern Africa, but that few studies used recommended alcohol screening instruments (Francis et al., 2014). Studies to estimate the prevalence of alcohol use and assess the impact of interventions to address hazardous alcohol use in Africa require validated screening tools, based on self-reports. The Alcohol Use Disorders Identification Test (AUDIT), a self-report alcohol screening tool for excessive drinking developed by WHO, has been used in both high and low income countries and

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recommended for use in primary care settings among adults (Chishinga et al., 2011; O'Connell et al., 2004; Saunders et al., 1993). A shorter version of AUDIT, the AUDIT-C that includes the first three questions of AUDIT on alcohol consumption is effective in AUD screening (Bush et al., 1998).

The Time Line Follow Back (TLFB) calendar method that also relies on self-reported information (in terms of quantity and frequency) has been mainly applied in high-income settings (Maisto et al., 1979; Sobell and Sobell, 1978; Sobell et al., 1986).

Expectations from peers and family members influence both the drinking behaviour of adolescents and young adults, and what they report about it; and these are likely to differ from those of adults (Gardner and Steinberg, 2005; Steinberg and Monahan, 2007). Because AUDIT and TLFB have been shown to be useful tools for alcohol screening in young people in some settings (Aertgeerts et al., 2000; Fleming et al., 1991; Sobell et al., 1986), they are potentially useful to inform alcohol interventions among young people in Africa as well; however, they have not yet been validated among such populations. The objective validation of self-reported alcohol consumption tests requires the use of alcohol biomarkers. A range of blood-based biomarkers exists including phosphatidylethanol (PEth), carbohydrate-deficient transferrin (CDT), and gamma-glutamyl transferase (GGT; Conigrave et al., 2002; Golka et al., 2004; Golka and Wiese, 2004). PEth is a direct ethanol metabolite in blood that has a comparatively long half-life, and therefore is able to discriminate between levels of alcohol use during the past one month (Isaksson et al., 2011; Varga et al., 1998; Viel et al., 2012). It has been used among adult populations globally, including in Sub Saharan Africa, to examine self-reported hazardous and harmful alcohol use (Bajunirwe et al., 2014; Hahn et al., 2012a, 2012b). PEth is very specific and sensitive for heavy and chronic alcohol intake, however it is difficult to establish the PEth cut off for heavy alcohol intake due to inter-individual metabolism rates for PEth (Stewart et al., 2010). For this paper, we have utilised the harmonised PEth cut off ($\geq$30 μmol/L) for heavy alcohol use for Swedish population (Helander and Hansson, 2013).

In this study, we compared self-reported alcohol use recorded by the one-month TLFB and AUDIT against PEth among college students and young casual labourers in northern Tanzania. To our knowledge, this is the first study using a specific alcohol biomarker (PEth) to compare self-reported alcohol use among young people in Africa.

2. Material and methods

2.1. Study populations and procedures

In March and April, 2014, we conducted a cross-sectional study among two groups of young people (college students and casual labourers) in Mwanza city, northern Tanzania. We aimed to enrol participants from these two groups, as they are known to include both modest and hazardous/harmful users of alcohol based on recently completed survey in this area. College students comprised students enrolled in higher learning institutions for diploma or undergraduate training, and young casual labourers were recruited from garages (car workshops). Casual workers from this sector are typical for male casual workers with unstable employment in this geographical setting and can be more easily identified than for example casual workers from temporary building sites. Participants were eligible if they were aged 18–24 years, reported having consumed alcohol in the last year and provided written informed consent. Impartial witnesses documented the consent for Illiterate study participants. None of the participants was under the influence of alcohol at the time of the interview. Ethical approval was received from the Lake Zone Institutional Review Board at the National Institute for Medical Research (NIMR), Mwanza (MR 53/100/155) and the Ethics Committee of the London School of Hygiene and Tropical Medicine (LSHTM ethics ref 7074). Permission was also obtained from heads of colleges and managers of garages.

At two randomly selected colleges, we randomly selected one class in each college and enrolled all volunteering eligible students. We consecutively visited garages in Mwanza city starting with large garages and enrolled all volunteering eligible casual workers until we attained the desired sample size. The study was performed by two lay research assistants who administered the AUDIT questionnaire (Saunders et al., 1993) and one-month TLFB calendar (Sobell et al., 1988), and two medical officers who drew blood samples.

We chose a sample size of 200 young people in total based on the assumption that the true prevalence of alcohol use in the last one month among young people in East Africa is about 28% (Francis et al., 2014), and the intention to determine sensitivities and specificities of self-reported alcohol use against PEth, which is only formed in the presence of ethanol (Helander and Zheng, 2009), with reasonable precision. With a sample of 200 participants, we expected about 46 true positives and 154 true negatives. For a sensitivity of 80% we would expect a 95% confidence interval (CI) ranging from 70.2% to 88.0%; and for a specificity of 95% a 95%CI interval from 88.5 to 98.7%.

2.2. Measurement of self-reported alcohol use

Self-reported alcohol use was documented using AUDIT and TLFB. We applied the TLFB method for any alcohol intake in the past one month in combination with an alcohol pictorial display, a list of commonly available types of beverages with their standard drinks equivalents and a brief questionnaire, jointly used to determine the type and actual amount of alcohol consumed as accurately as possible (see Supplementary material, file 1 and 2[1]). In addition, we also asked participants whether they had consumed alcohol in the past 2 and 6 months, respectively. We documented the amount of alcohol intake as standard drinks (1 standard drink being equivalent to 10 g of pure alcohol; World Health Organisation, 2000). We defined an intake of an average of $\geq$6 drinks per day as 'heavy alcohol intake' (World Health Organisation, 2014).

2.3. Blood sample collection, processing and laboratory assay for phosphatidylethanol (PEth)

Each study participant was asked to provide 5 mL of venous whole blood collected into EDTA vacutainer tubes. Before blood collection, the veni-pucture site was swabbed twice with clean water and allowed it to dry. Field workers were instructed not to use alcohol for sterilisation. The blood samples were immediately stored in a cool box in the field, and transferred to the NIMR laboratory within 3 h where they were kept at −80 °C.

Samples were shipped in dry ice to the Karolinska Institute and Karolinska University Laboratory (Stockholm, Sweden) for assay of PEth 16:0/18:1, the main PEth homologue in human blood (Helander and Zheng, 2009), using liquid chromatography-tandem mass spectrometry (LC–MS/MS). In the laboratory, samples were stored at −80 °C until taken for LC–MS/MS analysis, using selected ion monitoring (SIM) in negative mode of the deprotonated molecules (Zheng et al., 2011). The lower quantification limit (LLOQ) of the method for measurement of whole blood PEth 16:0/18:1 is 0.01 μmol/L. In Sweden, following a national harmonisation of PEth measurement (Helander and Hansson, 2013), the routinely applied cut-off to indicate "any intake of alcohol" for

[1] Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:10.1016/j.drugalcdep.2015.09.027.