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Prevalence of Ethanol Use Among Pregnant Women in Southwestern Uganda

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Abstract *Introduction* The prevalence of ethanol use in many Sub-Saharan African countries is high, but little research exists on use during pregnancy. The objective of this study was to assess the prevalence and predictors of ethanol use among pregnant women in Southwestern Uganda. *Methods* This descriptive, cross-sectional study was conducted in the maternity ward at Mbarara Regional Referral Hospital (MRRH). All pregnant women giving birth at MRRH between September 23, 2013 and November 23, 2013 were eligible for enrollment. The primary outcome was the proportion of women with ethanol use during pregnancy as determined by self-report. Secondary outcomes included the proportion with positive fatty acid ethyl ester (FAEE) results (indicating ethanol use) and positive TWEAK questionnaire results (indicating possible problem drinking). Predictors of ethanol use were assessed and stratified by patterns of ethanol intake. *Results* Overall, 505 mother–child dyads enrolled in the study. The proportion of women who reported any ethanol use during pregnancy was 16 % (n = 81, 95 % CI 13–19 %) and the prevalence of heavy drinking 6.3 % (n = 32, 95 % CI 3.8–7.9 %). The strongest predictor of use during pregnancy was pre-pregnancy use, with maternal education as a protective factor. Few neonates (n = 11, 2 %) tested positive for FAEE > 2.00 nmol/g in meconium. The TWEAK questionnaire captured 75 % of women who reported moderate/heavy drinking and aligned more with self-reported ethanol use than meconium results. *Conclusions* The substantial prevalence and clear predictors of ethanol use suggest that legislative action and educational interventions to increase awareness of potential harms could assist in efforts to decrease use during pregnancy in Southwestern Uganda.

Keywords Pregnancy · Ethanol use · Fetal alcohol spectrum disorder · Meconium · TWEAK

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Significance

What is already known on this subject? The use of alcohol among women in many countries within sub-Saharan Africa is rising.

What this study adds? This study evaluated alcohol use in over 500 mothers in Uganda during the course of their pregnancy. Sixteen percent of women consumed alcohol during their pregnancy with over six percent reporting heaving drinking. This study raises concern about the

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potential impact of alcohol use during pregnancy in Uganda and should prompt new policies to address this.

Introduction

The prevalence of ethanol use in many Sub-Saharan African (SSA) countries is high and is increasing among women [6, 10]. In a WHO survey in Uganda, 47 % of respondents reported they drank ethanol, and nearly one-third reported drinking daily. In recent years, the sex proportions have been shifting among new drinkers in Uganda, such that slightly more young (ages 18–29) women (28 %) reported drinking than men (26 %) [13].

Women who consume ethanol during pregnancy increase the risk of Fetal Alcohol Spectrum Disorder (FASD) and other preventable health conditions in their offspring [18]. Children diagnosed with FASD have demonstrated deficits in growth patterns, cognitive abilities, and central nervous system functioning [8]. Some regions of South Africa have high rates of FASD, but little data exist for other SSA countries.

Despite the high prevalence of ethanol consumption among women, few studies have explored the prevalence and predictors of its use specifically among pregnant women in SSA countries. Although consumption generally decreases during pregnancy, some areas continue to have unacceptably high rates of use [6]. In South Africa, the ethanol consumption rates during pregnancy have been reported between 20 and 43 % [6]. Another study conducted in Uganda found the prevalence to be 25 % among urban women following pregnancy recognition [6].

Due to the numerous consequences associated with AEP, it is imperative to understand the prevalence of and risk factors associated with ethanol use during pregnancy in SSA countries. This understanding could inform salient interventions to mitigate the negative effects of AEP. The objective of this study was to determine, using both maternal questionnaire and an analysis of fetal meconium for ethanol metabolites, the prevalence and predictors of ethanol use among women delivering at Mbarara Regional Referral Hospital (MRRH) in Mbarara, Southwestern Uganda.

Methods

Population

All pregnant women presenting to the maternity ward at MRRH in active labour between September 23, 2013 and November 23, 2013 were eligible for enrollment. Consent was sought either in early labor or following delivery. Women were excluded if: (1) the child died following delivery or was transported to another ward where meconium collection was not possible; (2) the mother–child pair was discharged prior to the passing of the first meconium; or (3) the mother was sufficiently ill to preclude adequate informed consent, as deemed by study personnel. This study was approved by the institutional review boards at the University of British Columbia (H13-00453) and the Mbarara University of Science and Technology (No. 03/02-13), and the Uganda National Council for Science and Technology (HS 1401).

Study Procedure

Following consent and delivery of the child, women were administered a standardized questionnaire to elicit demographic characteristics, level of education, basic prenatal history, tobacco and ethanol use, and attitudes about risks of ethanol use during pregnancy. Ethanol use 1 year prior to pregnancy, prior to pregnancy recognition (but during pregnancy) and during each trimester was assessed. Women were asked about the type, frequency, and quantity of ethanol consumed during these periods.

Women who reported the use of ethanol before or during pregnancy also received the TWEAK questionnaire, a previously validated screening tool for ethanol use during pregnancy [1, 17]. The scale consists of five items (Table 1) scored out of 10 points, with a positive test being a score of 2 or more points, indicating possible problem drinking [16].

In addition to self-report, meconium samples were collected during labor or after delivery from neonates of all enrolled women. Samples were collected, frozen and analyzed for concentration of the ethanol metabolite fatty acid ethyl ester (FAEE), a biological marker of maternal ethanol

Table 1 TWEAK screening questionnaire

1. Tolerance—How many drinks does it take to make you feel high?
2. Worry—Have close friends or relatives worried or complained about your drinking in the past year?
3. Eye opener—D you sometimes take a drink in the morning when you first get up?
4. Amnesia—Has friend or family member ever told you about things you said or did while you were drinking that you could not remember?
5. Kut/cut down—Do you sometimes feel the need to cut down on your drinking?

intake during the second and third trimesters of pregnancy [9]. When a woman consumes ethanol during pregnancy, elevated levels of FAEE are found in meconium [5, 19]. FAEE has been shown to have high specificity for prenatal ethanol exposure, though it is not specifically correlated with amounts of maternal consumption [5]. Meconium analyses of FAEE concentrations were completed at Motherisk in Toronto, Canada. Risk enhancing fetal ethanol exposure was classified as FAEE concentration >2.00 nmol/g meconium, based on previously reported cut-offs [4].

Outcomes

The primary outcome of this study was the proportion of subjects with ethanol use, of any amount, during pregnancy as determined by self-report. Secondary outcomes included: (1) the proportion of newborns with positive meconium analysis results (indicating ethanol use); and, (2) the proportion of subjects with a positive score on the TWEAK questionnaire.

Ethanol use, as determined by self-report, was further categorized according to three patterns of use during pregnancy: (1) any use during pregnancy; (2) "consistent use", defined as use during all three trimesters; or, (3) "heavy consumption", defined as weekly use during any trimester or any binge drinking (five or more drinks during any single occasion) during pregnancy.

Sample Size

There is no data reporting the prevalence of ethanol use in pregnancy in the southwestern region of Uganda, thus precise estimates of the sample size required for this study are not possible. One study investigating ethanol use during pregnancy in an urban population reported a prevalence of approximately 25 % [11]. Using a conservative estimate of regional prevalence of 5 %, we determined that a sample size of 500 would be required to attain 95 % confidence intervals of between approximately 3.5 and 7.5 %.

Analysis

Descriptive statistics were used for the reporting of the primary outcome. Associations between maternal characteristics and ethanol use during pregnancy were assessed using univariate logistic regression. Biologic and self-report indicators of ethanol use were descriptively compared (Tables 2, 3, 4). The proportion of neonates with FAEE > 2.00 nmol/g [4] was compared to: (1) the proportion of women reporting heavy drinking during

Table 2 Baseline characteristics of enrolled participants

Participant characteristics	Mean ± SD or N (%) or Median (IQR)
Maternal education	
Primary or no education	277 (55 %)
Secondary education	154 (30 %)
Post-secondary education	74 (15 %)
Marital status	
Married/living together	473 (94 %)
Single	30 (6 %)
Pregnancy history	
Previous pregnancies	2 (1–3)
Number of living children	2 (1–3)
Maternal age	24 ± 5.8
Paternal age	30 ± 6.8
Locale	
City (urban)	236 (47 %)
Trading center (semi-urban)	61 (12 %)
Village (rural)	208 (41 %)
HIV status	
Positive	49 (10 %)
Negative	431 (85 %)
Unknown	24 (5 %)
Substance use	
Current smoker	1 (0.2 %)
Current use of alcohol by partner	195 (39 %)
Alcohol use in year prior to pregnancy	93 (19 %)

Table 3 Definitions of outcomes and estimated population prevalence

Label	Definition	Prevalence (%)	95 % CI
Outcome 1	Any alcohol use during pregnancy	81 (16.04)	12.9–19.4
Outcome 2	Alcohol use during all 3 trimesters	20 (3.96)	1.85–4.68
Outcome 3	Weekly alcohol use during any trimester or any binge drinking during pregnancy	32 (6.34)	3.83–7.93

Table 4 Univariate logistic regression analysis of baseline variable against three alcohol use outcomes

Variable	Outcome 1 (n = 81) OR (95 % CI)	Outcome 2 (n = 20) OR (95 % CI)	Outcome 3 (n = 32) OR (95 % CI)
Maternal age (years)	0.98 (0.94–1.02)	1.00 (0.92–1.09)	0.99 (0.92–1.06)
Paternal age (years)	0.99 (0.96–1.03)	1.03 (0.96–1.09)	1.00 (0.95–1.06)
Previous pregnancies	0.96 (0.84–1.10)	1.04 (0.82–1.31)	1.00 (0.82–1.21)
HIV positive (vs negative)	1.17 (0.55–2.53)	1.81 (0.51–6.48)	1.58 (0.52–4.76)
Married (vs single)	0.96 (0.36–2.59)	1.21 (0.16–9.39)	0.41 (0.13–1.25)
Pre-pregnancy alcohol	16.5 (9.5–28.9)	48.8 (11.1–214.9)	10.6 (4.9–22.8)
Partner drinks	3.07 (1.88–5.02)	3.91 (1.48–10.34)	1.64 (0.80–3.35)
Risk perception (Ref = Always harmful)			
Sometimes harmful	0.54 (0.31–0.94)	0.36 (0.12–1.09)	0.38 (0.16–0.89)
Always safe	4.46 (2.28–8.64)	2.41 (0.82–7.12)	1.94 (0.78–4.87)
Education (Ref = None or primary)			
Secondary	0.70 (0.41–1.21)	*	0.89 (0.41–1.96)
Post-Secondary	0.37 (0.15–0.89)	*	0.36 (0.08–1.56)
Locale (Ref = City)			
Trading Center	1.80 (0.89–3.62)	0.97 (0.26–3.54)	1.50 (0.56–4.01)
Village	1.12 (0.67–1.89)	0.46 (0.16–1.33)	0.69 (0.31–1.57)

* Too few outcomes for reliable regression estimates

pregnancy; and, (2) the proportion of women with a positive TWEAK scale. Analyses were conducted using Microsoft Excel (Redmond, WA) and SAS 9.3 (Carey, NC).

Results

Subjective Characteristics

During the study period, 606 women were screened for enrollment (Fig. 1). Overall, 505 mother–child dyads were enrolled in the study with a mean maternal age of 24 years (Table 2). Women from both urban (n = 236, 47 %) and rural (n = 208, 41 %) residences were well represented. The mean paternal age was 30 years, and many women (n = 195, 39 %) reported that their husband or partner drank.

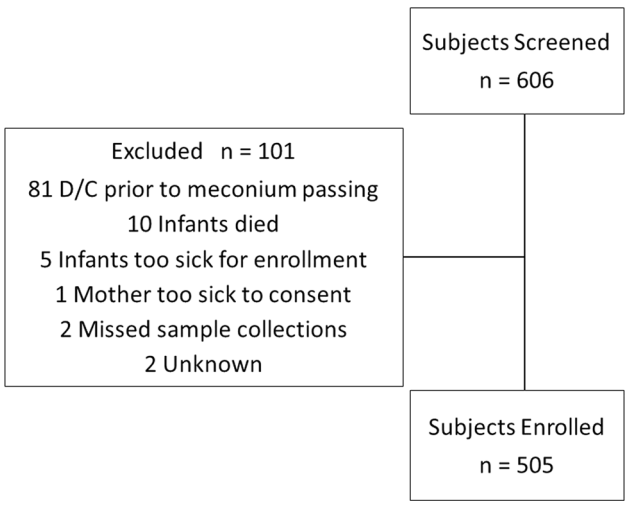

Fig. 1 Study enrollment

Prevalence of Ethanol Use by Questionnaire

Among the 505 women enrolled in the study, the proportion of subjects who reported any ethanol use during the current pregnancy was 16 % (n = 81, 95 % CI 13–19 %). "Consistent use", and "heavy consumption" during any trimester, were less common, reported by 3.2 % (n = 20, 95 % CI 1.9–4.7 %) and 6.3 % (n = 32, 95 % CI 3.8–7.9 %) of women respectively (Table 3). Of the 81 women reporting any use, 45 (56 %) reported use during only one trimester post-recognition (Fig. 2). Among women reporting "heavy consumption" use, 6 reported binge drinking during pregnancy. In total, 37 (7 %) women reported use during the first trimester, 43 (9 %) during the second trimester, and 54 (11 %) during the third trimester.

The type and quantity of ethanol intake per occasion of consumption were comparable before and after pregnancy recognition. Up to 1 year before pregnancy, 18 % (n = 93, 95 % CI 15.3–22.3 %) of women reported ethanol use, with the most common types of ethanol intake being beer (n = 62) and local spirits (n = 16) and the majority consuming 1–2 drinks on average. Of these women, over half (n = 52) reported continued ethanol use during pregnancy.

Predictors of Ethanol Use

Pre-pregnancy use was the strongest predictor of consumption during pregnancy (Table 4). Women reporting pre-pregnancy use had higher odds of any use during pregnancy (OR = 16.5, 95 % CI 9.5–28.9), use during all three trimesters (OR = 48.8, 95 % CI 11.1–214.9), and heavy consumption during any trimester (OR = 10.6, 95 % CI 4.9–22.8). In addition, use by a partner or spouse was significantly associated with any maternal use during pregnancy (OR = 3.07, 95 % CI 1.88–5.02) and use during all three trimesters (3.91, 95 % CI 1.48–10.34).

Maternal education served as a protective factor against use during pregnancy. Women with post-secondary school education had 63 % lower odds of use during pregnancy than those with only some or no primary school education (OR = 0.37, 95 % CI 0.15–0.89). Low risk perceptions of ethanol use during pregnancy were significantly associated with any consumption (OR = 4.46, 95 % CI 2.28–8.64). HIV status, maternal age, paternal age, marital status and locale were not independently associated with self-reported use.

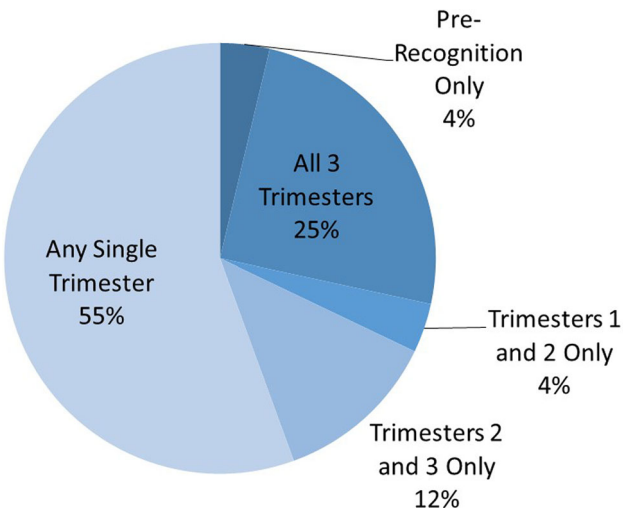

Fig. 2 Drinking behaviors of the 81 women reporting ethanol use during pregnancy

TWEAK Questionnaire

Of the 81 women who reported ethanol use during pregnancy, 79 completed the TWEAK screening questionnaire (two participants were missing the questionnaire due to incomplete self-report). Fifty-three percent (n = 42) of these women scored 2 points or more on the TWEAK scale, indicating the possibility of problem drinking. Twenty-four of the 32 women (75 %) who reported heavy use during pregnancy were captured by the TWEAK scale, scoring 2 points or more.

Biomarker of Ethanol Use

Few neonates (n = 11.2 %) tested positive for FAEE > 2.00 nmol/g. The median concentration for these neonates was 4.60 nmol/g, with a range from 2.5 to 5.58 nmol/g. Forty-four samples were considered borderline with FAEE concentrations between 0.4 and 2.00 nmol/g.

Notably, only 4 of the 11 mothers with neonates testing positive for FAEE reported ethanol use during pregnancy, all of whom the TWEAK identified as at risk of problem drinking. The remaining 7 mothers of neonates with positive FAEE results did not report use and therefore did not complete the TWEAK. In particular, the percentage of women testing positive for FAEE (2 %), indicating significant fetal ethanol exposure during pregnancy, did not align with the percentage who reported moderate/heavy use during pregnancy (6.3 %, n = 32). Among women who self-reported moderate/heavy drinking in the second or third trimesters (n = 25), only 12 % had positive FAEE analyses.

Discussion

We performed a descriptive study reporting the prevalence of ethanol use among pregnant women presenting to a regional referral hospital in Southwestern Uganda. We

found that 1 out of 6 pregnant women reported using any alcohol during pregnancy, while 1 out of 25 reported heavy drinking. FASD, resulting from ethanol-exposed pregnancies, is a preventable disease with significant social and economic implications. A heightened focus on the prevention of ethanol-exposed pregnancies in this region is urgently required.

The single previous study performed in Uganda examining the prevalence of ethanol use in pregnancy examined woman concentrated within the capital city of Uganda (Kampala) and reported a prevalence rate in Uganda (24.8 %) [11] which differs from our results. Differences in patient characteristics, however, may explain this discrepancy as subjects in our study population represented women from a different urban source in addition to women from rural locations.

In this study, few (2 %) meconium samples revealed significant fetal ethanol exposure. Interestingly, this biologic outcome did not align with self-reported use. During the second and third trimesters, 5 % of women reported moderate/heavy drinking behavior during pregnancy. FAEE levels would be expected to increase in response to such use. Therefore, self-report may indicate a different exposure threshold than this biologic measure. Cut-off levels distinguishing naturally occurring FAEE from ethanol induced FAEE are estimated, but dose–response is not clearly defined [3–5]. According to these findings, improved understanding of the association between FAEE and ethanol intake are needed to increase practical usage of this biologic indicator. It is interesting to note that self-reported use was higher than use determined through meconium analysis. Studies in Canada have found similar rates of ethanol exposure as determined via FAEE analysis but substantially lower rates of self-report, possibly due to additional stigma associated with use compared to this region of Uganda [2, 7].

The TWEAK questionnaire captured 3 out of 4 women who reported moderate/heavy drinking. Though the sample size was small ($n = 32$) among these women, the TWEAK seemed to align more with reported ethanol use than FAEE results. On the other hand, seven participants reported no use during pregnancy (therefore did not complete the TWEAK), but they tested positive for FAEE, strongly suggesting use during the second or third trimesters. Therefore, dependence on self-report alone could underestimate the prevalence of use and preclude some pregnant women from early interventions.

Maternal education (higher than the primary level) and the perceived risks of ethanol-related consequences were both strong predictors of ethanol-related behavior. These factors suggest that educational interventions to increase awareness of the potential harms could assist in efforts to decrease use during pregnancy in Southwestern Uganda. Three AEP prevention strategies have been previously described—universal, selective, and indicative—which intervene at various levels of the socioeconomic framework [12, 14, 15]. In addition to educational interventions targeting pregnant mothers, clinicians providing prenatal care have a role in alerting women about this issue, which provides impetus to incorporate prevention strategies into medical training programs. Legislative approaches, such as alcohol bottle labelling, point of sale warnings, or age-based purchase restrictions, may begin to address this issue from on a societal level. Further effort, funding, and studies are required to investigate the most effective interventions to reduce the prevalence of AEP. Whereas, the majority of literature supporting and guiding the use of educational interventions to prevent AEP is focused in middle and high income countries, specific emphasis needs to be placed in resource-limited contexts.

The primary limitation of this study was subjectivity or ambiguity in measuring ethanol use. Self-reported use may be influenced by reporting and/or recall biases. Ugandan women may not want to report use due to social pressures, such as criticism from others and partner abuse, leading to the possibility of lower reporting of intake [13]. Importantly, women were asked to recall their drinking behaviors up to one year prior to pregnancy, raising the possibility of inexact recall. Biologic measurement of ethanol intake via FAEE in meconium was also limited due to undefined dose–response associations [3].

This study identified a high prevalence of ethanol use among pregnant women in Southwestern Uganda. The predictors of use during pregnancy identified here highlight the potential benefits of educational programs about AEP and FASD in this community. Improved methods of screening for ethanol use during pregnancy have the potential to better identify at-risk women and lead to earlier intervention during pregnancy.

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