Original Article

Alcohol Consumption during Pregnancy and its association with Fetal Outcome in a Mountainous District of Nepal

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ABSTRACT

Background: Alcohol use during pregnancy has a negative health impact on pregnancy outcomes. There are inconsistencies in the relationship between alcohol consumption and outcomes in different scenarios. The studies done in Nepal on alcohol consumption have not looked for the consequences of alcohol consumption on pregnancy outcomes. Hence, this study assessed the maternal alcohol consumption practice and its effect on birth in the *Sindhupalchowk* district.

Methods: Facility-based analytical study was conducted in nine health facilities with delivery services in *Sindhupalchowk*. Face-to-face interviews were done with 250 newly delivered mothers at the health facilities using pretested semi-structured questionnaire. Descriptive, logistic regression analyses were done. Participation was voluntary, and written informed consent was taken.

Results: The study showed the prevalence of alcohol consumption during pregnancy among the newly delivered mothers was 35.6% (29.70 - 41.40). Among the study participants, four (1.6%) had stillbirths. Most of them (82.4%) had of normal birth weight. Low and moderate alcohol consumption was not seen to be significantly associated with low birth weight. However, its risk was seven times more in heavy drinking mothers and nine times among binge drinkers than non-drinkers.

Conclusions: One out of three mothers consumed alcohol during pregnancy. Risk of low-birth-weight babies was highest with binge drinking during pregnancy. The most commonly consumed type of alcohol was *Jaand* which has cultural roots. Interventions to help mothers avoid alcohol consumption must be based on the cultural context, and local stakeholders and beneficiaries should be sensitized to the harm alcohol cause especially during pregnancy.

Keywords: Alcohol, Pregnancy, Low birth weight, *Jaand*, *Sindhupalchowk*, Nepal

INTRODUCTION

Alcohol use during pregnancy has a negative health impact on pregnancy outcomes.[1] Physiologically decreased alcohol metabolism during pregnancy, alcohol easily crossing the placental barrier, uteroplacental-malperfusion, and relatively less

alcohol dehydrogenase for alcohol metabolism in the fetus resonates with this notion. [2–4] Being culturally associated, the pattern of alcohol consumption and its social tolerance during pregnancy varies from one community to another.[5] In the Nepalese context, people of Mangoloid origin use alcohol for rituals, religious occasions, and social drinking at festivals, and special occasions like birth and death are a norm.[6] Also, drinking alcohol is related to getting rid of the travail at the time of delivery.[7] A study in Nepal showed that every nine pregnant women in 100 consume alcohol.[7] High alcohol intake during pregnancy increases the risk of miscarriage, abortion, preterm labor, low birth weight (LBW), intrauterine growth retardation, and small for gestational age babies. In addition, many confounding factors like smoking, socioeconomic status, and maternal distress affect alcohol's role in fetal outcomes.[8] However, there are inconsistencies in evidences on alcohol consumption and outcomes in different scenarios.[8–12]

The studies done in Nepal on alcohol consumption have looked for the prevalence of alcohol consumption, knowledge about the harm it causes to an individual or fetus during pregnancy, reasons, and factors behind the consumption.[5–7,13] Still, the studies have not looked for the consequences of alcohol consumption on pregnancy outcomes. Hence, this study assessed the maternal alcohol consumption practice and its effect on birth in the *Sindhupalchowk* district, taking into account other factors like maternal stress, smoking, tobacco consumption, maternal BMI, and socioeconomic status.

MATERIALS AND METHODS

Facility-based analytical study conducted in health facilities with delivery services in *Sindhupalchowk* district of mountainous ecological belt in Nepal, with indigenous Tamang community comprising 40% of the total population.

Based on prevalence of acceptance of alcohol during pregnancy and observations made on various occasions *Sindhupalchowk* district was selected for study.[5,6,13] Nine health facilities with maximum number of deliveries- one district hospital, two primary health care centers, four health posts, and two private hospitals had been selected for study. Taking 13.2% prevalence of alcohol consumption among women of reproductive age (STEPS survey 2013), at 95% confidence interval and 90% power, sample size for study was 250.[14] Women who delivered in the selected health facilities were included. Data collection was done from September to December 2014 till sample size was met. Women referred elsewhere for delivery and/or non-resident of *Sindhupalchowk* district were excluded.

Ethical clearance was received from Institutional Review Board, Institute of Medicine. Permission was taken from the Health Office, *Sindhupalchowk* and in-charge of respective health facilities before data collection. Written informed consent was taken.

Research tool included socio-demographic characteristics, maternal history, socioeconomic status (SES), smoking and alcohol consumption level throughout the pregnancy period, mental status of participants and newborn's outcome. SES of the participants was calculated using principal component analysis. Information on alcohol consumption included its type, amount, timing of consumption, level, and frequency. Alcohol consumption was categorized based on grams, as follows.[14]

Low: 10-49 grams per occasion (consumption up to 2 standard drinks per occasion)

Moderate: ≤70 grams of alcohol/ week (consumption of more than 2 standard drinks per occasion)

Binge (≥50 grams of alcohol per occasion) less frequently than weekly; Binge 1-2 times per week

Heavy: >70 grams of alcohol/week

Number of standard drinks formula:
Standard Drinks = Volume * percentage of alcohol * specific gravity of ethyl alcohol
where, percentage of alcohol was based on the type of alcohol: Beer, *Jaand*, tongba = 5%, local *Raksi* = 40%, whisky, vodka= 40% and wine= 12%.[14]

Mental status was assessed using the validated Nepali version of Patient Health version of Patient Health Questionnaire 9 (PHQ9) for depression and Beck's Anxiety scale for anxiety.[15] Mother found to have anxiety or depression was considered to have mental distress for analytical purposes. And newborn's outcome included birth weight, live or stillbirth, gestational age at delivery.

Face to face interview was done at health

facility after at least six hours post-delivery or once she is comfortable participating in the study. Women found to consume alcohol were informed about harmful effects of alcohol consumption with counseling to quit it gradually in days to come, immediately after the interview with her. Women, who were distressed, were referred to nearby health facility with psychological counseling and treatment facilities.

Descriptive, logistic regression analyses were done using Statistical Package for Social Sciences (SPSS) (Version 16) software. Categorical variables were presented as percentage and frequency, mean and standard deviation was calculated for continuous variable. Bivariate and multivariate analyses were done to see the association between exposure and outcome variables. Odds ratios and 95% confidence interval were used to find out the significance of the association. Variables significant in bivariate analysis (p<0.05) and other potential confounders were checked for multicollinearity, and those with VIF (Variance Inflation Factor) less than ten were included in multivariate analysis. To measure the net effect size of variables, adjusted odds ratio was calculated. Hosmer and Lemeshow's chi-square test were used to test the goodness-of-fit.

RESULTS

The mean age (±standard deviation) of mothers was 25.68 (±5.30) years. Almost half of the study respondents (46.8%) were from the disadvantaged *Janjati* group. The majority of the study participants (84.4%) follow Hinduism. Nearly one of the four participants (21.6%) had completed their lower secondary and secondary education. One out of four pregnant women (25.6%) was found to be illiterate (Table 1).

The majority of the study participants (86.0%) didn't smoke during pregnancy. When the pregnant women's mental state was assessed, almost one in four respondents (23.2%) was found to have mental distress (Table 2).

The prevalence (95% confidence interval) of alcohol consumption was 35.6% (29.70 - 41.40). Fourteen percent had low alcohol consumption, 12.4% had moderate alcohol consumption, 6.4% had heavy alcohol consumption, and 2.8% had binge alcohol consumption. Among participants who consumed alcohol, 89.8% consumed *Jaand* (home-brewed alcohol made from the fermentation of grains) (Table 3).

Table 1: Socio-demographic characteristics of participants

Characteristics	Number (n=250)	Percentage (%)
Age (in years)		
< 30	189	75.6
≥30	61	24.4
Mean ± SD	25.68±5.30	
Ethnicity		
Disadvantaged *Janajatis*	117	46.8
Upper caste	64	25.6
Dalit	36	14.4
Relatively advantaged- *Janajati*	30	12.0
Disadvantaged *non-dalit (*Terai caste)	2	0.8
Religious minorities	1	0.4
Religion		
Hinduism	211	84.4
Buddhism	31	12.4
Christianity	8	3.2
Educational Status		
Illiterate	14	5.6

Literate (non-formal)	37	14.8
Primary education	44	17.6
Lower Secondary	54	21.6
Secondary education	54	21.6
Higher Secondary	38	15.2
Bachelors and above	9	3.6

Table 2: Smoking and mental distress among the participants

Characteristics	Number (n=250)	Percentage (%)
Smoking during pregnancy		
No smoking	215	86.0
<5 cigarettes/day	27	10.8
≥5 cigarettes/day	8	3.2
Mental distress		
Absent	192	76.8
Present	58	23.2

Table 3: Prevalence and level of alcohol consumption among study participants

Variables	Number (n=250)	Prevalence (95%CI)	Prevalence among alcohol consumers (95%CI)
Alcohol consumption			
No	161	64.4 (60.90-67.00)	-
Yes	89	35.6 (29.70-41.40)	-
Level of alcohol consumption			
Low	35	14.0 (0.40-27.60)	39.3 (28.80-49.10)
Moderate	31	12.4 (0.20-23.70)	34.8 (2.80-65.12)
Binge	07	02.8 (0.04-03.93)	07.8 (1.70-12.30)
Heavy	16	06.4 (3.06-08.90)	17.9 (9.20-24.80)

Neonate outcome of study participants

Most of neonates (82.4%) were of normal birth weight, 13.6% were of low birth weight, 1.6% were stillbirths and 2.4% were preterm. Since, the number of stillbirths and pre term births were low, these outcomes were excluded from bivariate and multi-variate analysis. (Table 4, Table 5) .

In bivariate analysis, women aged 30 years and above (OR,4.27;95% CI, 1.94-9.39), in those who smoked during pregnancy (OR,3.48;95% CI, 1.47-8.23) (Table 4) and those who were categorized as binge drinkers (OR, 11.07; 95% CI 2.02-60.51) and heavy drinkers (OR 8.61; 95% CI, 2.75- 26.91) (Table 5) during pregnancy were more likely to give birth to LBW babies.

When birth weight was analyzed as a continuous variable, alcohol consumption decreased birth weight by 164 grams.

Table 4: Unadjusted association of selected characteristics with low birth weight

Characteristics	Pregnancy Outcome		OR (95% CI)	P value
	LBW n(%)	No LBW n(%)		
Age (in years)				
≥30	14 (41.2)	29 (14.9)	4.27(1.94-09.39)	<0.001*
<30	20 (58.8)	177 (85.9)	Ref	
Ethnicity				
Disadvantaged *Janajati*	16 (47.1)	97 (47.1)	0.99 (0.48-02.06)	0.998
Others	18 (52.9)	109 (52.9)	Ref	
Educational status				
≤10 grade	29 (85.3)	168 (81.6)	1.31 (0.47-03.61)	0.599
SLC and above	05 (14.7)	38 (18.4)	Ref	
Parity				
Primipara	12 (35.3)	83 (40.3)	1.23 (0.58-02.63)	0.581
Multipara	22 (64.7)	123 (59.7)	Ref	
Sex of newborn				
Male	17 (50.0)	109 (52.9)	1.12 (0.54-02.32)	0.753
Female	17 (50.0)	97 (47.1)	Ref	
Socioeconomic status				
Lowest	15 (44.1)	67 (32.5)	2.64 (0.97-07.22)	0.057
Middle	13 (38.2)	68 (33.0)	2.26 (0.81-06.29)	0.118
Highest	6 (17.6)	71 (34.5)	Ref	
Maternal Distress				
Yes	7 (20.6)	41 (19.9)	1.04 (0.42-02.56)	0.926
No	27 (79.4)	165 (80.1)	Ref	
Pre-pregnancy BMI				
<18.5	5 (14.3)	14 (06.8)	4.04 (1.08-15.13)	0.038
18.5-24.9	23 (67.6)	124 (60.2)	2.10 (0.81-05.40)	0.124
≥25	6 (17.6)	68 (33.6)	Ref	
Smoking				
Yes	24 (70.6)	184 (89.3)	Ref	0.003
No	10 (29.4)	22 (10.7)	3.48 (1.47-08.23)	

Note: OR- odds ratio; LBW-Low birth weight; BMI- body mass index; Ref= Reference category

In multivariate analysis, low and moderate alcohol consumption was not significantly associated with LBW after adjusting for SES, pre-pregnancy BMI, age, ethnicity, educational status, occupation, maternal distress, parity, newborn's sex, and smoking. The odds of LBW was seven times more in heavy drinking mothers and nine times among binge drinker mothers (AOR, 9.63 with 95% CI 1.49-62.64) than non-drinkers. (Table 5).

The predictability of the logistic regression equation model was 83.2%. The model used in this section explained only 16.7% of dependent variables as Nagelkerke R Square was 0.167 (Hosmer and Lemeshow 0.875). The prediction equation is:

$$Y = -1.60 \text{ (constant)} + 1.27x_1 + 2.67x_2 + 1.87x_3$$

(where, Y= Log odds of Adverse Fetal Outcomes x_1=moderate alcohol consumption; x_2= binge alcohol consumption; x_3=heavy alcohol consumption.)

Table 5: Adjusted risk of Low birth weight in mothers consuming alcohol during pregnancy

Level of Alcohol Consumption	Pregnancy Outcome		OR (95% CI)	OR* (95% CI)
	LBW	No LBW		
No alcohol consumption	13 (38.2)	144 (69.9)	Ref	Ref
Low	6 (17.6)	28 (13.6)	2.37 (0.83-06.77)	1.66 (0.55-05.01)
Moderate	5 (14.7)	22 (10.7)	2.51 (0.81-07.75)	2.19 (0.64-07.40)
Binge	3 (08.8)	3 (01.5)	11.07 (2.02-60.51)	9.63 (1.49-62.64)
Heavy	7 (20.6)	9 (01.4)	8.61 (2.75-26.91)	7.15 (1.74-29.36)

Note: Adjusted by age, ethnicity, educational status, occupation, socioeconomic status, maternal distress, pre-pregnancy BMI, parity, newborn's sex, smoking
Ref-Reference Category   OR*- Adjusted OR

DISCUSSION

Our study results showed a higher prevalence of alcohol consumption (35.6%) during pregnancy among mothers than the percentage of women of reproductive age consuming alcohol as per the 2013 STEPS survey and another population-based study by Narbada Thapa et al., later published in 2016.[5,14] This might be because of a traditional practice of alcohol consumption during pregnancy to get rid of travail.[7] However, the present study results are consistent with the cohort study by Krishna et al, which mentions that 33% of the pregnant women in *Sindhupalchowk* districts consume alcohol during pregnancy.[16] Also, in our study, 89.8% of pregnant women consumed *Jaand* (home-brewed alcohol made from the fermentation of grains). The most common consumption was *Jaand*, which sounds reasonable as it is easily accessible (home-brewing). In addition to it, culture also favors *Jaand* consumption to other alcoholic drinks.

Low and moderate alcohol consumption was not seen to be significantly associated with LBW, while the odds of LBW was seven times more in heavy drinking mothers when compared to non-drinkers. The odds of LBW was seen to be nine times among binge drinkers than that among non-drinker mothers. The fetal outcomes are consistent with a cohort study conducted by O' Leary et al., where the rate of LBW infants was highest among those exposed to binge drinking or heavy drinking.[17] In the particular study, information about alcohol consumption during each trimester was asked.[17] This result was also supported by a prospective study in London district hospital where a significant trend towards lower birth weight with increasing alcohol consumption was seen.[18] And a cohort study conducted in Ireland where high alcohol intake was associated with LBW on univariate analysis.[19] However, this association was not statistically significant after controlling for confounding factors like parity, socioeconomic status, age, illicit drugs, nationality, and marital status considered in the study.

This relationship between binge and heavy alcohol consumption and LBW can be explained by decreased alcohol metabolism during pregnancy, alcohol easily reaching the fetus, and less alcohol dehydrogenase to metabolize the alcohol in the fetus, specifically when the consumption of alcohol is high and the time duration those drink is minimum.[2-4]

In contrast, to the present study, where low and moderate alcohol consumption was not found to be significantly associated with LBW, a cohort study carried out in New Haven concluded light drinking as a significant risk factor for LBW (RR,1.89; 95% CI, 1.21-2.94).[9] The probable explanation for this might be the classification of alcohol exposure with binge drinking as a separate category in the present study, which avoids the inclusion of binge drinking in the low or moderate category, posing it to be responsible for LBW.

Another study concluded consumption of <6gm/day of alcohol decrease the risk of LBW (AOR 0.64; 95% CI, 0.40-0.88), which is also in contrast to the present study that shows a positive relationship between low alcohol consumption and LBW, even though not a significant one.[20] Unlike the present study findings, where heavy alcohol consumption was significantly associated with birth weight, Miyake et al. reported maternal alcohol consumption of 1.0 g or more per day during pregnancy was not associated with LBW or small for gestational age though it was

significantly positively associated with the risk of preterm births.[21] The discrepancy might be because of the difference in study population and categories of alcohol consumption used in the study.

When birth weight was analyzed as a continuous variable, alcohol consumption decreased birth weight by 164 grams. This finding resembles the study from the British cohort, where alcohol consumption was associated with an approximately 100-gram reduction in birth weight for women consuming > 2 units/wk in the first trimester.[22]

Recall bias might have affected the result of the study as mothers who delivered were asked to recall the amount of alcohol consumption throughout their pregnancy period. Information was collected being specific about trimesters to address the bias. Information bias might occur while calculating alcohol consumption by pregnant mothers. We address this bias by using show card with different vessels or glasses commonly used to drink alcohol to determine the amount of alcohol consumption. The number of standard drinks consumed was calculated using the

formula. Since the population distribution of *Sindhupalchowk* is different from the nation, the generalizability of the study should be done cautiously.

CONCLUSIONS

One out of three mothers consumed alcohol during pregnancy. Risk of low-birth-weight babies was highest with binge drinking during pregnancy. The most commonly consumed alcohol was *Jaand* which has cultural roots. Interventions to help mothers avoid alcohol consumption based on the cultural context and sensitize the local stakes and beneficiaries on alcohol harm are recommended.

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