Maternal smoking

Effect of smoking and alcohol use during pregnancy on the occurrence of low birthweight in a farming region in South Africa

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Summary

The aim of this case–control study was to determine the risk factors for low birthweight in a farming region in South Africa, with particular attention to maternal alcohol use and smoking, both independently and in combination. Data collection was via structured postpartum interviews and review of antenatal and delivery records. The study setting was a regional referral hospital in a farming region. The study subjects were 200 infants with birthweight <2500g (cases) and 200 unmatched control infants of normal weight born during the same period as the cases. The outcome measure was low birthweight, i.e. infant birthweight <2500 g.

Results showed the contribution of term low birthweight (as a measure of intrauterine growth retardation) to the total low-birthweight incidence was almost 50%, indicating a substantial intrauterine growth retardation component in this population.

Sociodemographic factors were not as predictive of low birthweight in this predominantly low income population. Smoking (adjusted OR 2.67, [95% CI 1.69, 4.20]) was the strongest life style-related predictor of low birthweight. The alcohol low-birthweight relationship was not significant when adjusted for smoking status (crude OR 2.15, [95% CI 1.37, 3.39]; adjusted OR 1.32, [95% CI 0.80, 2.20]). However, there appeared to be an interaction with combined use of these two substances during pregnancy that increased the risk of low birthweight (adjusted OR increased to 4.24, [95% CI 1.01, 17.76]. It is clear that life style factors such as smoking and drinking are contributing to the occurrence of low birthweight in the target region. A comprehensive health promotion programme needs to be implemented as an integral part of antenatal and family planning services, to reduce smoking and drinking by women in this community.

Introduction

Birthweight is a powerful predictor of infant growth and survival. Infants born with low birthweight (<2500 g) suffer from high rates of morbidity and mortality and often remain underweight, stunted or wasted from the neonatal period through childhood.[1,2] Moreover, evidence now shows that adults born with low birthweight face an increased risk of chronic diseases including high blood pressure, non-insulin dependent diabetes mellitus, coronary heart disease and stroke in adulthood.[1,2]

Risk factors for low birthweight include maternal under-nutrition, infectious diseases, anaemia, acute and chronic infections such as sexually transmitted diseases and urinary tract infections, chronic diseases such as hypertension, genetic disorders, diseases of pregnancy such as pre-eclampsia and life style factors such as alcohol, drug use and cigarette smoking.[1,2]

Cigarette smoking and pre-eclampsia produce the highest relative risks for intrauterine growth retardation (IUGR) in industrialised countries, while alcohol and drug abuse may also restrict fetal growth.[1,2] Studies have also examined the potential synergy between these life style factors to increase the incidence of low birthweight with sometimes conflicting results.[3–14]

The West Coast/Winelands region in the Western Cape Province of South Africa is primarily a farming region with five subdistricts. In 1999 there were 9461 births in this region of which 19.2% had a birthweight <2500 g[15] However, research examining the potential contribution of life style factors to low birthweight in the region had not been conducted. The aim of this study was to determine the epidemiology of low birthweight, with particular attention to alcohol consumption and smoking during pregnancy, both independently and in combination.

Despite the highest incidences of low birthweight being documented in developing countries,[1,2] to date, studies examining the combined effects of smoking and alcohol on birthweight have only been conducted in developed countries.[3–14] This is probably the first study to examine these relationships in a developing country. In addition, the population in this farming region of South Africa has the highest documented rate of fetal alcohol syndrome in the world.[16,17] Reports have consistently demonstrated high rates of both smoking and alcohol use during pregnancy in this population,[16,18] increasing the ability to examine the combined effects of these two behaviours in pregnancy.

Methods

This was a quantitative case–control study. The cases consisted of 200 infants born at the regional referral hospital with a birthweight <2500 g. The controls were 200 unmatched normal-weight infants born at the same hospital during the same period as the cases. Cases and controls were identified using the hospital delivery register. With an alpha of 0.05, the study had 80% power to detect an odds ratio (OR) of 1.7–1.8 for major exposures such as alcohol use and smoking during pregnancy.[19]

Mothers who had delivered infants were approached for participation in the study on the postnatal ward. Interviews were conducted in private via a structured questionnaire in the patient's preferred language.

Data were collected from mid-October 2002 to August 2003, except during the holiday period 15 December 2002–30 January 2003. Questionnaires were available in both English and Afrikaans, and included demographic details, pregnancy information, personal habits with regard to cigarette smoking, drug use, alcohol consumption and stress-related factors (Perinatal Self-Administered Inventory [PSAI[20]]). The four questions of the CAGE questionnaire[21] (a screening questionnaire for alcohol abuse/dependency) were also included in the interview tool. A perinatal record review was also completed. Data were collected from the antenatal, delivery and postpartum records of the mother and infant. The record review included: pregnancy and medical history, current pregnancy, delivery and neonatal complications, and pregnancy outcomes, and was adapted from a tool used in midwifery research.[22] Birthweight and gestational age were both obtained from the medical record (not the interview). Birthweight was the first recorded infant weight obtained after birth, within the first day. Gestational age was the estimate recorded in the medical record, and is assumed to represent the best available clinical estimate.

The interviewers had a health background and were trained by the investigators. A sample of duplicate record review and interview items were carried out by one investigator to ensure data quality (98% agreement was observed).

Data were captured in an Excel spreadsheet and imported into CDC Epinfo 2002[19] for analysis. Analyses included frequencies and cross-tabulations for categorical data, and means or medians and standard deviation or interquartile range for continuous data. ORs (cross-product) and 95% confidence intervals [CI] (Taylor Series) were the measures of effect.[19] Uncorrected chi-square or ANOVA[19] were used to test for associations between variables of interest. An additive model was used to assess interaction.[23]

The study received ethical approval from the Higher Degrees Committee of the University of the Western Cape. Signed informed consent was obtained from each participating pregnant mother prior to enrolment in the study.

Results

Of the 200 low-birthweight cases 95 (47.5%) were born preterm (<37 weeks gestational age) and 105 (52.5%)were term infants with low birthweight reflecting IUGR. Demographic and socio-economic data indicated that there was an equal number, 49 (24.5%), of single parents for both cases and controls (Table 1). Among the cases 37.2% had only primary school education (<8 completed years) compared with 20.1% among the controls. More cases (16.5%) than controls (6%) lived in shacks. Monthly income was recorded as the mothers' income only. Just less than half (45.2%) of the cases and 26% of controls earned less than R800 (US$120) per month; however, this difference was not statistically significant.

As would be expected, poor pregnancy history (e.g. previous preterm or low-birthweight infant) or current pregnancy complications (e.g. multiple pregnancy, antenatal or labour problems) were all predictive of low birthweight (Table 1). Parity was also predictive of low birthweight, with first pregnancy a protective factor (31.0% in cases vs. 44.5% in controls, $P = 0.005$). Neither planned pregnancy nor high stress score (PSAI > 3)[20] were associated with low birthweight.

Attendance at antenatal care (ANC) appeared to be protective against the occurrence of low birthweight (OR 0.47, $P = 0.011$) (Table 1). However, the number of weeks' gestation at first ANC visit was not associated with low birthweight (mean was 22.7 weeks in cases vs. 22.2 weeks in controls, $P = 0.468$) (Table 2). In addition, mean number of antenatal visits was associated with low birthweight (4.7 for cases vs. 6.1 for controls, $P < 0.001$) in the overall population, and the subset of women who delivered at term (5.3 vs. 6.1, $P = 0.013$). Shorter maternal height (mean 160 cm vs. 162 cm, $P = 0.014$) and low maternal weight at first antenatal visit were risk factors for low birthweight. There was no association between mean maternal haemoglobin status and low birthweight at the initial antenatal visit (11 g/dL for cases and controls, $P = 0.734$), or at delivery (12 g/dL for cases and controls, p = 0.539).

Smoking

Within the sample 61% of cases admitted to smoking during pregnancy compared with 35.4% of the controls (OR 2.97, $P < 0.001$) (Table 3). The mean age at which women began smoking was 16 years for both groups and was not significant ($P = 0.771$). In the non-smokers, living with a smoker was not associated with low birthweight. The majority of women who smoked said they were daily smokers. Being an occasional vs. a daily smoker was not associated with low birthweight, which may be due to the small number of occasional smokers (controls 4.9% vs. cases 3.0%, $P = 0.541$). Number of cigarettes smoked per day was not included in the questionnaire, but was obtained from the perinatal record review. The median number of cigarettes smoked per day was the same in cases and controls (five in both groups, $P = 0.256$).

Of those who smoked in this pregnancy, over half (54.4%) of controls smoked less than before pregnancy, in contrast with 38.8% of cases. Among the cases 32.2% smoked more and 28.9% smoked the same amount, compared with controls for whom 25.0% admitted to smoking more and 20.6% smoked the same during pregnancy (*P* = 0.116). A large percentage of smoking controls indicated that they tried to stop smoking in the past and this was significantly associated with low birthweight (cases 61.9% vs. controls 77.3%, OR 0.48 [95% CI 0.24, 0.95].

Alcohol consumption

Alcohol consumption during pregnancy was also a risk factor for low birthweight (OR 2.15, [95% CI 1.37, 3.38]). (Table 3) Seventy cases (35%) and 40 (20%) controls, admitted to alcohol ingestion during this pregnancy. The mean age for starting to drink was 17 years for both groups and was not associated with low birthweight (*P* = 0.449). Most of the drinking occurred at the weekend in a communal fashion, with beer and wine (including 'papsak' – poor quality wine in large foil bags) being primarily the types of alcohol consumed. Only two women, both cases, admitted to drinking during the week. Although more cases drank alcohol than controls, the amount consumed by the drinkers in both groups was similar [median number of bottles of alcohol (750 mL) per person per weekend was 1.7 for cases and 1.8 for controls] and not significantly different (*P* = 0.57). Similarly, the percentage with a CAGE[21] score >2 (which indicates problem drinking) was similar in both groups and was not associated with low birthweight (OR 1.28, [95% CI 0.59, 2.79]) (Table 3).

The majority of both cases and controls admitted that they smoked more when they drank but this was higher in the cases (71.6%) than the controls (63.6%, $P < 0.001$). However, number of reported cigarettes smoked per day and bottles of alcohol (750 mL) consumed per weekend were not significantly related (correlation coefficient – $r^2 = 0.01$, $P = 0.48$), suggesting that, in this population, as drinking or smoking increased there was no correlated increase in the other behaviour.

Multivariable analysis

Analyses taking account of confounders used simple stratified analysis or logistic regression using EpiInfo 2002[19] focusing on smoking and alcohol as the primary exposures of interest. Maternal education, type of house, parity, attendance at ANC, number of ANC visits, maternal height and weight, as well as number of cigarettes smoked and bottles of alcohol consumed per weekend were all assessed as possible cofactors. Factors found to be confounding the smoking or alcohol relation with low birthweight individually were then assessed for joint confounding (primary school only, first antenatal maternal weight, number of antenatal visits). Adjustment for maternal weight increased the estimates of the effect, while primary school only and number of antenatal visits reduced the effect, resulting in estimates of effect similar to adjustment for smoking and alcohol alone, with a corresponding loss of precision (Table 4). Inclusion of the number of cigarettes or bottles of alcohol per weekend appeared to cause instability in estimates and did not appear to add in terms of confounding over the inclusion of the binary smoking or drinking variables.

Independent and combined effect of smoking and alcohol use

Finally, the combined effects of smoking and drinking were examined (Table 4). The relationship between drinking and low birthweight was confounded by smoking (Crude OR 2.15; Adjusted OR 1.32, [95% CI 0.80, 2.20]), and the smoking effect appeared to be slightly confounded by alcohol (Crude OR 2.97; Adjusted 2.67, [95% CI 1.69, 4.20] but the effect remained statistically significant (Table 4).

More interesting, however, was that the effect of alcohol and smoking together (OR increased to 3.82, [95% CI 2.23, 6.55]) was higher than for those who smoked but did not drink (OR 2.20, [95% CI 1.34, 3.64]) or those who drank but did not smoke (which showed a non-significant protective relation with low birthweight, OR 0.61, [95% CI 0.21, 1.78]) (Table 4). Adjusting for first antenatal maternal weight, number of follow-up visits and primary school only, suggested slight confounding by these variables (Table 4). Therefore, analysing the adjusted estimates (Table 4) using an additive model[23] yields:

$$\text{OR (Smoking + Alcohol)} = [\text{OR (Smoking + No Alcohol)} + \text{OR (No Smoking + Alcohol)} - 1]$$

$$4.24 > 1.94 (= 2.29 + 0.65 - 1)$$

This suggests that smoking and drinking alcohol during pregnancy interacted to increase the risk of low birthweight more than either smoking or drinking alone, with over a doubling of risk.

Discussion

There is evidence that the higher the incidence of low birthweight in a population, the greater the proportion of IUGR, with the number of preterm babies remaining relatively constant.[24] The current study showed the contribution of term low-birthweight (as a measure of IUGR) and preterm delivery to the total low-birthweight incidence to be almost 50% each, therefore indicating a substantial IUGR component in this population. Several socio-economic factors, consistent with other studies[25,26] were associated with low birthweight, while other factors were not (Table 1). The majority of women in the study were of low socio-economic status. This may have accounted for some factors not being predictive of low birthweight in this study that have been seen to be risk factors in more socio-economically diverse study populations.

Of particular interest is that multiparity was associated with low birthweight, in contrast to previous studies that have shown primiparity as a risk factor for IUGR.[27] In this population multiparae, who are also older, may have been practising unhealthy life style behaviours, such as smoking and alcohol drinking, over a long period of time. This theory is supported by the results of research by Misra *et al*.[28] and Bonellie,[29] who showed interaction between smoking and increased parity, or increased maternal age, respectively, to increase the incidence of low birthweight.

Smoking

Smoking was found to be the strongest life style predictor of low birthweight. A very high percentage of women in this study smoked (61.9% cases and 35.4% controls). This is higher than other studies conducted in similar communities.[18,30] An alarming result showed that a number of women who smoked increased their smoking habit during pregnancy (32% cases vs. 25% controls). Potential for recall bias exists, in particular for quantity of cigarettes smoked per day as these data were obtained from the perinatal record rather than the questionnaire. As with any known risk behaviour women may have under-reported consumption.

A history of trying to quit smoking was associated with a reduction in low birthweight, which is very encouraging from the point of view of health promotion. Steyn *et al*.[31] and others[7,32] highlight that a reduction in smoking during pregnancy lowers the risk of low birthweight. Reduction in smoking, as well as attempts to quit, are more likely to occur among those women who receive non-smoking advice from medical staff.[31] Unfortunately, South African doctors and health professionals working in the public sector are not consistently addressing the issue of smoking during pregnancy.[33]

Alcohol consumption

Data in the study confirmed that patterns of high alcohol intake prevail in this community. Of the sample 35% of case mothers admitted to alcohol use during pregnancy. This is highly associated with low birthweight, in unadjusted analyses but the relationship was confounded by smoking. Consistent with other studies from this community[18,34] drinking of beer and wine occurred mainly at the weekend (Friday to Sunday) in a communal fashion. However, in the current study the total percentage of drinkers amounted to 28%, which is much lower than the reported rates of 42.8% to 56% in other studies in these communites.[18,30] This could be due to under-reporting because of the stigma attached to alcohol use during pregnancy, and that the study was conducted in the hospital rather than in communities.

The median number of bottles of alcohol (750 mL) consumed per weekend for both groups of drinkers (cases and controls) was similar. The level of alcohol intake might be expected to predict low birthweight. However, the drinking pattern of the mothers in the community was mainly binge drinking in a communal fashion, making the amount consumed difficult to estimate. In addition, the actual alcohol content of the bottles consumed was also not known as women consumed a variety of beer, wine and local ‘papsak’. Therefore, the measure above was only a crude estimate of approximate quantity, which appeared not to vary across the cases and controls who were drinkers. It is possible that cases were consuming alcohol with higher ethanol content, which may have contributed to higher rates of low birthweight, but we are unable to estimate this.

This limited data to assess alcohol quantity also may have contributed to the finding of no relationship between quantity of cigarettes smoked and quantity of alcohol consumed. To date no tool has been developed to accurately measure intake of alcohol in this community of primarily communal binge drinkers (Parry C, personal communication, March 2004). Development of such a tool should be priority for future research in this region.

In addition, the CAGE[21] score, which indicates level of alcohol abuse, was not associated with low birthweight. This could also have been due to under-reporting by the mothers, or that the CAGE may not be appropriate as a screening instrument for this community. However, Claasen[21] found the CAGE to be a valid measure of alcoholism in a similar community in South Africa.

Combined effects of smoking and alcohol use

The assessment of the interaction between these two variables suggested that when women both smoke and drink alcohol, their risk of low birthweight is increased above that if they smoke or consume alcohol alone.

Studies that have explored possible interaction between alcohol and smoking on birthweight have reported conflicting results.[3–13] Some authors,[3–7] have reported no interaction between alcohol and smoking in their data, whereas others[8–13] have reported positive interaction. Marbury *et al*.[14] reported that no 'significant' interaction between alcohol and smoking could be shown, despite the suggestion of positive interaction in their data, and suggested that they may not have had the power to detect it. Three of these studies,[3,5,14] assessed interaction based on the additive definition of independence using linear regression. Some studies[4,8–10] appear to have based their conclusions on inspection of the data. While they did not specify their definition of independence, the additive definition was suggested in their discussions.

Two recent studies have taken a similar approach to assessing interaction of smoking and alcohol use on birthweight as used in this report. Okah *et al*.[12] examined combinations of 'health-compromising behaviours' on term low birthweight, and concluded that term low birthweight increased with increased numbers of health-compromising behaviours during pregnancy and, in particular, noted 'the effect is especially pronounced when smoking is combined with alcohol consumption'. Mariscal *et al*.[13] examined patterns of alcohol consumption (weekday vs. weekend), as well as potential interaction of alcohol and smoking. They found that low-to-moderate drinking (<6 g/day alcohol) or weekend-only drinking in the absence of smoking reduced low birthweight. This finding is consistent with results from some researchers[7,35] but not others, who have found either an increased risk[36] or no risk[14] of low birthweight with low-to-moderate alcohol intake during pregnancy. Mariscal *et al*.[13] only found synergism between alcohol and smoking for those women who were weekday drinkers, but not weekend-only drinkers (even in the higher consumption category of 12 g/day). This is in contrast to our results, where essentially all the women in our study were weekend-only binge drinkers with fairly high consumption, and a substantial departure from independence was seen in the effects of combined use of alcohol and smoking on birthweight.

Our results suggest that a reduction in alcohol use during pregnancy could have an impact on reducing the overall occurrence of low birthweight, as well as the reduction of the documented high rates of fetal alcohol syndrome in this farming region. In addition, a study by Severson *et al*.[37] reported that drinking reduced the likelihood that women would quit smoking during pregnancy, suggesting that reducing drinking in pregnant women may also assist in efforts to encourage them to reduce or quit smoking.

Conclusion

It is clear that life style factors such as smoking and drinking are contributing to the occurrence of low birthweight in the target region. This indicates a need for a comprehensive health promotion programme to be developed and implemented as an integral part of antenatal and family planning services to reduce smoking and drinking in this community. Efforts should include training of health professionals to address smoking and drinking during healthcare contacts, as well as integrated health care and community health promotion programmes, such as the health promoting hospitals framework.[38]

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Tables

Table 1. Distribution of potential risk factors for low birthweight (<2500 g)

Variable	Cases (n = 200) %	Controls (n = 200) %	[OR 95% CI]
Teenagers (<20 years)	21.0	20.0	1.06 [0.65, 1.73]
Older mothers (>35 years)	11.0	7.5	1.52 [0.76, 3.03]
Primary school education only (<standard 6)	37.2	20.1	2.36 [1.50, 3.71]
Employed	21.5	25.0	0.82 [0.52, 1.31]
Mothers income <R800/month	45.2	26.0	2.35 [0.98, 5.65]
Resident on farm	36.5	30.5	1.31 [0.86, 1.99]
Resident in township	59.0	60.5	0.94 [0.63, 1.40]
Type of house – shack	16.5	6.0	3.10 [1.55, 6.19]
Marital status – single	24.5	24.5	1.00 [0.63, 1.58]
Race/Ethnicity – Black African	11.0	14.0	0.76 [0.42, 1.38]
No financial or emotional support from father of baby	14.0	15.0	0.92 [0.53, 1.61]
Stress score >3[a]	63.6	57.5	1.29 [0.86, 1.94]
Planned pregnancy	29.1	35.0	0.76 [0.50, 1.16]
Primipara	31.0	44.5	0.56 [0.37, 0.84]
Previous preterm	12.3	5.0	2.65 [1.22, 5.73]
Previous low birthweight	13.9	4.0	3.86 [1.70, 8.75]

Variable	Cases (n = 200) %	Controls (n = 200) %	[OR 95% CI]
History of pregnancy complications	28.9	17.6	1.92 [1.18, 3.13]
Attendance at antenatal care	81.0	90.0	0.47 [0.26, 0.85]
Began antenatal care after 1st trimester	91.8	88.9	1.40 [0.67, 2.92]
Antenatal problems (current pregnancy)	55.1	27.1	3.33 [2.17, 5.26]
Multiple pregnancy	7.5	0.5	16.13 [2.11, 123]
Preterm labour	47.5	1.0	89.57 [21, 370]
Labour and delivery problems	63.0	29.5	4.07 [2.68, 6.18]

[a]Answered yes to more than 3 items on the Perinatal Self-Administered Inventory.[20]

Table 2. Distribution of means of potential risk factors for low birthweight (<2500 g)

Variable	Cases (n = 200) (SD)	Controls (n = 200) (SD)	P-value[a]
Number of weeks gestation at 1st antenatal care visit	22.7 (6.7)	22.2 (6.7)	0.468
Maternal height (cm)	160 (7.4)	162 (8.2)	0.014
Maternal weight at 1st antenatal care visit (kg)	60 (12.6)	70 (16.9)	0.004
Number of antenatal care visits	4.7 (2.9)	6.1 (2.7)	<0.001
Haemoglobin at 1st antenatal care visit	11.4 (1.2)	11.4 (1.3)	0.734
Haemoglobin at delivery	11.9 (2.0)	12.1 (1.9)	0.539

Variable	Cases (*n* = 200) (SD)	Controls (*n* = 200) (SD)	*P*-value[a]
Gestational age at delivery	36.2 (2.9)	39.6 (0.9)	<0.001

[a] ANOVA (EpiInfo 2002, V.3.3.2).

Table 3. Smoking status and alcohol use of the cases and controls

	Cases (*n* = 200) %	Controls (*n* = 200) %	OR [95% CI]
Current smokers	61.9	35.4	2.97 [1.96, 4.48]
Smokers who smoked daily	57.4	31.8	2.89 [1.91, 4.37]
Living with smokers	58.9	63.0	0.84 [0.44, 1.63]
Alcohol ingestion (% answering yes to current drinking)	35.0	20.0	2.15 [1.37, 3.39]
CAGE score >2 (scale 0–4)	53.6	47.5	1.28 [0.59, 2.79]

	Median (IQR)	Median (IQR)	*P*-value[a]
Number of cigarettes smoked per day	5.0 (3.0–5.0)	5.0 (3.0–6.0)	0.256
Number of bottles of alcohol (750 mL) per person per weekend	1.7 (1.0–2.7)	1.8 (1.0–3.0)	0.573
CAGE Score (scale 0–4)	3.0 (2.0–3.0)	2.0 (1.5–3.0)	0.304

[a]Mann–Whitney/Wilcoxon two-sample test (Kruskal–Wallis test for two groups) (EpiInfo 2002, V.3.3.2).

Table 4. Assessment of confounding and joint effects of smoking and alcohol on low birthweight (<2500 g)

	Cases ***n*** **(%)**	**Control** ***n*** **(%)**	**UOR [95% CI]**	**AOR [95% CI]**	**AOR [95% CI]**
Smoking	(61.9)	(35.4)	2.97 [1.96, 4.48]	2.67 [1.69, 4.20][a]	2.76 [0.91, 8.33][b]
Alcohol	(35.0)	(20.0)	2.15 [1.37, 3.39]	1.32 [0.80, 2.20][a]	1.38 [0.37, 5.12][b]
Neither smoking or alcohol	70 (35.5)	111 (57.8)	1.00 Reference	1.00 Reference[c]	
No smoking + alcohol	5 (2.5)	13 (6.5)	0.61 [0.21, 1.78]	0.65 [0.05, 8.75][c]	
Smoking + no alcohol	57 (28.5)	41 (20.5)	2.20 [1.34, 3.64]	2.29 [0.68, 7.74][c]	
Smoking + alcohol	65 (32.5)	27 (13.5)	3.82 [2.23, 6.55]	4.24 [1.01, 17.76][c]	

[a]Adjusted for smoking and alcohol.

[b]Adjusted for smoking, alcohol, first antenatal maternal weight, primary school only, number of antenatal visits.

[c]Adjusted for levels of smoking and alcohol, first antenatal maternal weight, primary school only, number of antenatal visits.

UOR, unadjusted adds ratio; AOR, adjusted odds ratio.