

ORIGINAL RESEARCH

The Effect of nicotine/alcohol consumption during pregnancy period on Maternal and Infant Outcomes in Rural region of India: A Randomised Trial

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ABSTRACT

Background: Perinatal problems can occur in fetuses who have been exposed to alcohol or tobacco. The relationship between alcohol and tobacco use and the motor and cognitive development of infants, whether used separately or concurrently, is currently poorly understood. **Objective:** The goal of this study is to determine whether maternal use of tobacco or alcohol during pregnancy affects the motor and cognitive development of the fetus. **Methods:** 316 mothers and children from a cohort who were first assessed during the prenatal period (22–25 weeks of pregnancy), then again after birth, were included in the study. According to the alcohol and/or tobacco use indicated by the mothers at delivery, the children were split into four groups: those who had neither used alcohol nor tobacco (NC), those who had each used it separately (AC), those who had both used them simultaneously (ACTC). Mother's postpartum depression, gestational age, and intrauterine development limitation were all assessed. The third edition of the Bayley Scale of Infant and Toddler Development screening instrument was used to evaluate the children's motor and cognitive development. **Results:** Less mothers without partners, mothers under the age of 20, and mothers over the age of 35 took part in the follow-up in greater numbers. The moms in the ACTC group had lower gestational ages, higher rates of intrauterine growth restriction, and more postpartum depression cases. The only group that demonstrated an increased risk of motor delay, notably for fine motor skills, when compared to the NC group was the ACTC group; separate alcohol or cigarette usage did not. **Conclusion:** Smoking cigarettes and drinking while pregnant had a negative impact on the health of the mother, the unborn child, and the mother's life. The negative effects of these substances and the child's long-term growth were increased by concurrent alcohol and cigarette usage.

Keywords: Alcohol, Nicotine, Pregnancy, Child growth, Paediatrics

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INTRODUCTION

Although awareness of the harmful effects of smoking and alcohol use during pregnancy on the fetus and the newborn is spreading more widely, this habit still poses a serious problem for people all over the world. In a survey of 21 centers across 17 countries, the International Child Care Practices Study found that, on average, 22% of mothers and 45% of fathers smoked at the time of their child's birth [1]. Even though there are significant regional differences, this most likely represents the fetus's single largest

modifiable neuropharmacological exposure. The health of the mother and the fetus is at risk when habits like smoking or drinking alcohol during pregnancy are practiced. Numerous studies have shown that maternal use of tobacco or alcohol during pregnancy has a negative impact on fetal development, morbidity, cognitive growth, and behavior in children and adolescents [2–5].

Alcohol and nicotine that have been chewed or smoked while pregnant diffuse through bodily fluids and the placenta to reach the amniotic fluid. As a

result of this process, fetal growth and the development of the central nervous system may experience subtle or even drastic changes [6]. Toxins from cigarettes, such as carbon monoxide, nicotine, cyanide, cadmium, and lead, may change placental function, which then reduces the fetus's access to oxygen and nutrients and raises the risk of perinatal adverse events [7]. Because it can activate acetylcholine nicotine receptors and pass through the placental barrier, nicotine also has an adverse effect on the development of the nervous system. Thus, as demonstrated in various studies, fetuses exposed to nicotine may exhibit a deficit in the number of neurons and significant changes in their sensorial-cognitive functions [8].

Fetal exposure to alcohol and/or tobacco may also be associated with long-term harm to a variety of developmental parameters [9], in addition to perinatal health problems. Depending on how often, how much, and how long a fetus is exposed to alcohol, different things can happen to how an infant develops. The first year of life was reportedly marked by poor mental and psychomotor development in the offspring of women who consumed high alcohol doses continuously throughout their gestation [10]. On the other hand, infant development was not hampered by low-moderate alcohol use that was interrupted early in pregnancy. Regarding tobacco consumption during pregnancy, some studies have suggested an association with damage to developmental and behavioral parameters [11-13].

Although numerous studies have examined the impact of alcohol or tobacco use during pregnancy on motor and cognitive behavior, they have generally ignored the effects on the developing fetus when both substances are present. Studies on perinatal outcomes have shown that fetuses who are simultaneously exposed to alcohol and tobacco are more likely to be premature and experience intrauterine growth restriction than their peers who are only exposed to one or none of these substances [14,15]. But compared to groups exposed to just one or none of these substances, little is currently understood about the impact of concurrent use of alcohol and tobacco during pregnancy on infant motor and cognitive outcomes. Although it can be challenging to distinguish how each substance affects the fetus, some studies indicate that alcohol and tobacco may act synergistically to increase the risk of perinatal adverse events. As a result, the goal of the current study was to look into the relationship between maternal use of tobacco and/or alcohol during pregnancy and the motor and cognitive development of children beginning in the second year of life.

MATERIALS AND METHODS

SUBJECT

A convenience sample of pregnant women was used in this prospective cohort study, which began in the prenatal period (2020–21). From the start of the

second year of life (2021–2022), mothers and children were assessed.

Because there were no records of pregnant women or women who received prenatal care in this population, it was impossible to obtain a representative random sample of pregnant women. As a result, a convenience sample was used. According to the following inclusion criteria, pregnant women evaluated in government, public, and private hospitals were invited to join the prenatal cohort: they had to have undergone an obstetric ultrasound examination before the 20th week of pregnancy, have a gestational age between 22 and 25 weeks at the time of data collection, and be carrying a singleton. Thus, data were gathered from 600 pregnant women who were part of the prenatal cohort.

A previously trained team collected information on the reproductive health, demographic and socioeconomic data, pregnancy characteristics, depressive symptoms, and daily routines of the chosen subjects through conducting interviews and using a standardized questionnaire. The Clinical Research Unit conducted interviews with the subjects and evaluated them. Out of these 600 expectant women, 79.3% (n=476) of the original cohort's women and their newborns took part in the study when they gave birth. Losses from the original sample (n=124) were attributed to abortion (n=32), refusal to participate in the interview after delivery (n=52), inability to find the mother while she was hospitalized (n=21), and early discharge from the hospital (n=19).

DATA COLLECTION

Every day, teams of interviewers who had undergone training from the investigators visited the maternity hospitals to distribute predetermined questionnaires. Interviews with the mothers in the maternity hospitals yielded the following information: identification, reproductive health information, characteristics of the pregnancy, delivery, and birth, maternal traits and lifestyle choices, including smoking and alcohol consumption, demographic and social data, and health issues during childbirth. The team gathered newborn anthropometry data (weight, length, and head circumference) from patient files at the hospitals.

FOLLOW-UP OF CHILD DEVELOPMENT

Beginning in the second year of a child's life, a follow-up study with mothers and kids who had taken part in the earlier stages of the study was carried out. A group of psychologists and pediatricians with prior training assessed the children's development during this phase.

In addition to the abortion already identified in the previous phase, the teams discovered eight stillbirths and twelve deaths during the first year of life. As a result, 456 participants were evaluated.

INDEPENDENT VARIABLE

The mother's combined alcohol and tobacco use during pregnancy was the independent variable when she was questioned at the time of childbirth. The following questions were asked:

- Did you drink beer during pregnancy?
- Did you drink wine during pregnancy?
- Did you have any other type of drink such as whiskey, vodka, gin or rum?
- Did you smoke during this pregnancy?

Alcohol consumption was deemed present when the participant reported consuming any amount of at least one of the aforementioned alcoholic beverages while she was pregnant. The participant was considered a smoker if she reported smoking any number of cigarettes per day. Based on this, there were four groups for this variable: no consumption (NC), alcohol consumption alone (AC), tobacco consumption alone (TC), and alcohol and tobacco consumption together (ACTC).

As previously demonstrated, questions about the gestational period, frequency, and severity of consumption were asked of the pregnant women who admitted to consuming any kind of alcoholic beverage. According to this information, the amount of absolute alcohol in each drink (5% in beer, 12% in wine, and 40% in liquors) was used to categorise alcohol use during pregnancy [16]:

- Low (1 to 20 g absolute alcohol per day)
- Moderate (21 to 40 g absolute alcohol per day)
- High (41 g or more absolute alcohol)

Smoking habits among the TC and ACTC groups were categorized as 5 cigarettes per day, 6 to 10 cigarettes per day, and >10 cigarettes per day in order to determine tobacco use profiles. It was not stated how long the smoking took to gestate.

DEPENDENT VARIABLE

The Bayley Scale of Infant and Toddler Development Third Edition - Screening (Bayley-III screening)'s fine motor subscale (FMS), gross motor subscale (GMS),

and cognitive scale (CS) were used to measure both motor and cognitive development [17]. During cohort follow-up, infants between the ages of 13 and 30 months were assessed. This scale allowed us to assess if development was proceeding as expected or whether a more thorough evaluation was required. While the GMS evaluates activities involving interlimb coordination, displacement, motor planning, and postural stability, the FMS instrument incorporates assessments that allow the measurement of the handgrip, perceptual-motor integration, and motor planning. The instrument's cognitive subscale consists of activities for evaluating attention, preferences for novelty and habituation, problem-solving, exploration and manipulation, concept creation, and other cognitive development-related abilities.

STATISTICAL ANALYSIS

The characteristics of patients who were present and missing during follow-up were compared to those of the groups (NC, AC, TC, ACTC) using the chi-squared test. The data were examined using the Stata statistical software, version 14 (USA), with the significance level for all tests set at 5%.

RESULTS

Following the follow-up, a comparison of the characteristics of the participants who were present and those who were not indicated disparities in marital status, mother's age, and social class. During the follow-up, fewer moms without partners (3.8% vs. 20.7%), mothers under the age of 20 (15.9% vs. 21.6%), and mothers over the age of 35 (20.9% vs. 48.6%) participated (Table 1). There was no discernible difference between the participants who were present and those who were absent throughout the follow-up in terms of intrauterine growth restriction, gestational age, CES-D, or educational level.

Table 1: Characteristics of the participants who were present or absent during follow-up

Characteristics	Total no. of participants n=456	Absent during follow-up n=140	Present during follow-up n=316	P value
	n (%)	n (%)	n (%)	
Intrauterine growth restriction				0.341
No	388 (85.1)	122 (87.2)	266 (84.2)	
Yes	68 (14.9)	18 (12.8)	50 (15.8)	
Gestational age (weeks)				0.714
≥37	394 (86.3)	118 (84.5)	276 (87.0)	
<37	62 (13.7)	22 (15.5)	40 (13.0)	
Newborn's gender				0.78
Male	216 (47.4)	68 (48.5)	148 (46.8)	
Female	240 (52.6)	72 (51.5)	168 (53.2)	
CES-D				0.041
Without depressive symptoms	353 (77.4)	110 (78.3)	243 (76.9)	
With depressive symptoms	103 (22.6)	30 (21.7)	73 (23.1)	
Marital status				0.241

Married	310 (68.0)	88 (62.9)	222 (70.3)	
Consensual union	105 (23.0)	23 (16.4)	82 (25.9)	
No partner	41 (9.0)	29 (20.7)	12 (3.8)	
Mother's schooling (years)				0.046
College Degree	156 (34.2)	65 (46.4)	91 (28.8)	
9th to 12th standard	140 (30.7)	40 (28.6)	100 (31.6)	
≤8 standard	160 (35.1)	35 (25.0)	125 (39.6)	
Mother's age (years)				0.02
≥35	134 (29.4)	68 (48.6)	66 (20.9)	
20-34	244 (53.5)	42 (30.0)	202 (63.4)	
<20	78 (17.1)	30 (21.4)	48 (15.9)	

EFFECT OF ALCOHOL AND/OR TOBACCO CONSUMPTION DURING PREGNANCY ON OUTCOMES

Based on their alcohol and tobacco use during pregnancy, we divided 456 mothers into four groups: those who did not use either substance (NC), those who did (AC), those who did (TC), and those who did (ACTC). 51.6% of the participants belonged to group NC, 17.7% to group AC, 20.2% to group TC, and 10.4% to group ACTC, according to the comparison of the groups present at the follow-up. The ACTC

group had a greater relative frequency of mothers with depressive symptoms (40.0%), gestational age 37 weeks (15.2%), and infants born with intrauterine growth restriction (17.2%). Mothers without a partner were more prevalent in the TC group (39.1%). More mutual consent was noted in the ACTC group (36.4%). Additionally, there were notable differences in these groups' educational levels. In the ACTC group, 45.5% of moms had only completed grades 9 through 12, whereas in the TC group, 46.9% of mothers reported using cigarettes.

Table 2: Comparison of the characteristics of groups NC, AC, TC, and ACTC

Characteristics	Groups				P value*
	NC, n (%)	AC, n (%)	TC, n (%)	ACTC, n (%)	
	n=163 (51.6)	n=56 (17.7)	n=64 (20.2)	n=33 (10.4)	
Intrauterine growth restriction					0.028
No	149 (91.1)	48 (84.9)	53 (83.3)	27 (82.8)	
Yes	14 (8.9)	8 (15.1)	11 (16.7)	6 (17.2)	
Gestational age (weeks)					0.041
≥37	152 (93.2)	49 (87.3)	56 (87.8)	28 (84.8)	
<37	13 (6.8)	7 (12.7)	8 (12.2)	5 (15.2)	
Newborn's gender					0.561
Male	80 (49.1)	29 (51.2)	32 (50)	16 (49.8)	
Female	83 (50.9)	27 (48.8)	32 (50.0)	17 (50.2)	
CES-D					0.018
No depressive symptoms	128 (78.8)	42 (75.3)	42 (65.5)	20 (60.0)	
Depressive symptoms	35 (21.2)	14 (24.7)	24 (34.5)	13 (40.0)	
Marital situation					<0.01
Married	84 (51.5)	31 (55.3)	18 (28.1)	13 (39.4)	
Consensual union	35 (21.5)	17 (30.4)	21 (32.8)	12 (36.4)	
No partner	44 (27.0)	8 (14.3)	25 (39.1)	8 (24.2)	
Mother's schooling (years)					0.214
College Degree	57 (35.0)	22 (39.9)	15 (23.4)	9 (27.3)	
9th to 12th standard	60 (36.8)	21 (37.5)	19 (29.7)	15 (45.5)	
≤8 standard	46 (28.2)	13 (23.2)	30 (46.9)	9 (27.3)	
Mother's age (years)					0.251
≥35	93 (57.1)	25 (44.7)	11 (17.2)	13 (39.4)	
20-34	35 (21.5)	19 (33.9)	27 (42.2)	9 (27.3)	
<20	35 (21.5)	12 (21.4)	26 (40.6)	11 (33.3)	

Over the course of the three trimesters of pregnancy, the majority of the pregnant women drank alcohol in amounts that were deemed moderate (20 g/day).

Additionally, the ACTC and AC groups' levels of gestational intake did not differ according to the data. Additionally, among smokers, 79.5.2 percent in the

TC group and 84.1.0 percent in the ACTC group said they smoked fewer than 10 cigarettes every day. The quantity of smokes between the ACTC and TC groups was the same.

According to the findings, only the ACTC group had a larger risk of motor delay than the NC group (56.8 % in ACTC vs 31.1% in NC), particularly with relation to fine motor skills. Separate use of alcohol or tobacco did not result in a delay in either gross motor or cognitive development. The danger of delayed development of fine motor skills rose with the simultaneous use of the two drugs, though.

DISCUSSION

The current study looked into the relationship between maternal use of tobacco, alcohol, or both during pregnancy and the child's second-year motor and cognitive development. The findings showed that children who were simultaneously exposed to the two drugs ran the risk of FMS delays. As opposed to the reference group (NC), no difference was found between the AC and TC groups.

The AC group's similarity to the NC group's may be attributed to the fact that almost all of the participants reported consuming little or no alcohol while pregnant. Additionally, there was no correlation between low/moderate maternal alcohol intake and poor Bayley III score at 24 months of age [18]. A meta-analysis likewise found no link between behavioral abnormalities and prenatal exposure to low to moderate amounts of alcohol, but it did find developmental problems in fetuses exposed to high concentrations [19]. However, as different parameters and criteria for classifying the level of alcohol intake are employed in the various studies, these results should be regarded with caution. Additionally, other factors, including continued use and the length of time the fetus is exposed to alcohol, may be risk factors for delayed child development and should be taken into account.

The results of the current investigation did not show a connection between pregnant mothers who smoke separately and delayed baby development. Numerous studies have demonstrated that factors like a socioeconomic family situation, maternal education, domestic environment, parental psychiatric conditions, and infant birth circumstances taken into account in the analyses may attenuate the association between maternal smoking habit and deficits of infant development [12,13]. When the analysis was corrected for family socioeconomic circumstance and parental mental health, independent of the number of cigarettes smoked, Roza et al.'s population-based cohort study [12] failed to find any negative effects of a mother smoking on child behavioral assessments at 18 months of age. However, Huijbregts et al. [13] noted that neonatal weight significantly mediates the relationship between maternal cigarette use and infant motor and cognitive deficits and modifies

confounding factors like family wealth and maternal education.

Despite the fact that the amounts of alcohol and cigarette usage in the AC and TC groups are comparable, results show that concurrent use of the drugs is linked to delays in the FMS. In our study, the analyses were modified to account for the pregnant women's mental health, age, marital status, and economic class. However, it turned out that consuming both drugs was bad for growth. On the other hand, since behavioral traits frequently exhibit non-linearity, this may help to explain why there isn't a connection between GMS and CS delays. Cognitive delays typically manifest as more advanced cognitive skills are learned over time, in contrast to motor deficiencies, which can be detected early. Children who were exposed to other prenatal risk factors showed the same results. These groups frequently exhibit delayed FMS throughout the second year of life, recovery of GMS impairments by 12 months of age, and subpar performance by the time they reach school age [20,21].

Prematurity and intrauterine growth restriction (IUGR) were more common in the ACTC group than in other groups in our population. Given that IUGR and prematurity are linked to delays in the development of fine motor skills in childhood [22], these conditions may be mediating the link between the concurrent use of alcohol and tobacco during pregnancy and delays in the development of fine motor skills.

The following advantages of the current study need to be emphasized: The study was unique in examining the motor and cognitive development of children concurrently exposed to alcohol and tobacco during the prenatal period because it was a cohort investigation with three prospective measurements initiated during the prenatal period, had a relatively high follow-up representativeness compared to the initial phase, and was the first of its kind.

CONCLUSION

The risk of motor and cognitive impairments throughout the second year of life was not linked to separate alcohol or cigarette use. It is significant to note that the majority of individuals indicated moderate alcohol and cigarette use. Although at modest levels, simultaneous exposure to the two drugs raised the risk of delayed development of fine motor abilities. Early risk factor identification during pregnancy is crucial for the implementation of preventative and therapeutic strategies.

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