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Alcohol intake during pregnancy and fetal alcohol syndrome

Abstract

Alcohol intake during pregnancy is a major public health challenge because of the numerous deleterious effects on a developing fetus. A range of contextual and structural factors such as poverty, histories of trauma and violence, physical and mental health concerns, sociocultural and economic vulnerabilities, and child welfare involvement are influences the utilization of alcohol consumption during pregnancy. Binge drinking; which means an intake of greater or equal to 5 drinks on a single occasion is the most hazardous pattern of alcohol drinking that can cause high blood alcohol concentration and injuries the unborn fetus by passing across the placenta. Fetal alcohol syndrome can be described by a specific pattern of abnormal facial features, growth retardation, and central nervous system abnormalities which frequently result in behavioral and/or cognitive disabilities. Teratogenic effects of fetal alcohol exposure may lead to actual and potential challenges, instantly after birth, at infancy, or even later, leading to anatomical abnormalities, behavioral problems, and mental impairment in life. Bilateral renal agenesis is occurred during the second month of pregnancy; if the pregnant women consume the alcohol heavily. The deformities of cardiac abnormalities demonstrated from prenatal alcohol exposure are plastic kidneys, dysplastic kidneys, ureteral duplications, hypoplastic kidneys, hydronephrosis, and horseshoe kidneys.

Keywords: alcohol intake, binge drinking, fetal alcohol syndrome, pregnancy, teratogenic effects

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Abbreviations: ADHD, attention deficit hyperactivity disorder; FAS, fetal alcohol syndrome; FASD, fetal alcohol spectrum disorders; HIV/AIDS, human immunodeficiency virus/acquired immunodeficiency syndrome; IQ, intelligence quotient; NTD, Neural tube defects; PAE, prenatal alcohol exposure

Introduction

Many adverse health effects for the developing fetus such as intrauterine growth retardation, low birth weight, learning disabilities, behavior disturbances, spontaneous abortion, structural malformations, pre- and post-natal growth retardation, central nervous system deformity, and neurodevelopmental deformities and fetal alcohol syndrome are correlated with maternal alcohol consumption during pregnancy.[1–3] Alcohol intake during pregnancy is a major public health challenge because of the numerous deleterious effects on a developing fetus.[4,5] Alcohol intake during pregnancy causes death greater than that resulting from other diseases like HIV/ AIDS, tuberculosis, and diabetes. Potential acute and chronic negative health consequences on the health of women and children are linked to alcohol consumption during pregnancy.[6–8] The body of the fetus during the developmental stage does not identically process alcohol as an adult does; the alcohol is highly concentrated in the body of the fetus, and it can inhibit the passage of adequate amount of nutrition and oxygen to the crucial organs of the fetus.[9–11] The degree of alcohol utilization among women of childbearing age from fifteen to forty nine years are recently elevating in most countries globally, due to factors such as economic advancement, changing gender roles, and social acceptability of alcohol utilization in women.[12–14] Globally an approximately about ten percent of women drunken alcohol during pregnancy, with the highest rates of alcohol utilization during pregnancy being resulted in Russia, the United Kingdom, Denmark, Belarus, and Ireland are 36.5%, 41.3%, 45.8%, 46.6% and 60.4% respectively.[15] A range of contextual and structural factors including poverty, histories of trauma and violence, physical and mental health concerns, sociocultural and economic vulnerabilities and disadvantage, and child welfare involvement are influences the utilization of alcohol consumption during pregnancy.[16,18] Alcohol readily crosses the placenta and affects the fetal development directly; if drunken during pregnancy and eventually alcohol drunken during pregnancy may change fetal advancement indirectly by disrupting the normal hormonal interactions between the mother and the fetus.[18] The level of effects of alcohol usage during pregnancy perhaps different based on the frequency of exposure to alcohol, dose, duration, genetic factors (alcohol dehydrogenase enzyme; which is low in women than men), maternal nutrition, and developmental stage of the fetus at exposure.[19,20] Binge drinking; which means an intake of greater or equal to 5 drinks on a single occasion is the most hazardous pattern of alcohol drinking that can cause high blood alcohol concentration and injuries the unborn fetus by passing across the placenta.[21,22] Fetal alcohol spectrum disorders (FASD) correlated from heavy alcohol intake during pregnancy is an umbrella term encompassing a range of behavioural, cognitive and learning disorders, of which fetal alcohol syndrome represents the more severe end of the spectrum, and compromised gestational growth and preterm birth.[23] FAS can be described by a specific pattern of abnormal facial features, growth retardation, and central nervous system abnormalities which frequently result in behavioral and/or cognitive disabilities.[24,25] Pediatric with FAS have characteristic of facial features such as (small palpebral fissures, smooth philtrum and thin vermillion border of the upper lip), prenatal and/or postnatal growth retardation, and central nervous system structural and/or functional deformities.[26] The neurocognitive deficits in fetal alcohol syndrome and fetal alcohol spectrum disorder are includes hyperactivity, impulsivity, difficulties with planning and mental organisation, concrete thinking, visuospatial problems, lack of awareness of social cues, and difficulties understanding the consequences of their own behaviour.[27,28] The frequent cognitive and behavioural challenges in pediatric with fetal alcohol spectrum disorder are attention deficit hyperactivity disorder, inability to foresee consequences, inability to learn from previous experience,

inappropriate or immature behaviour, lack of organization, learning difficulties, poor abstract thinking, poor adaptability, poor impulse control, poor judgement, and speech, language and other communication problems.[29] Ethanol diffuses through the placenta and distributes rapidly into the fetal compartment, accumulating in the amniotic fluid and this reservoir causes greater fetal exposure to ethanol and is intensified by fetal swallowing, caused by the fetal kidneys excreting xenobiotics into the amniotic fluid, which is then swallowed by the fetus. Alcohol has prolonged consequences on the fetus due to amniotic accumulation, lowered concentrations of fetal metabolic enzymes, and decreased elimination, which results in damage to the developing embryo and fetus. Teratogenic effects of fetal alcohol exposure may lead to actual and potential problems, instantly after birth, at infancy, or even later, leading to anatomical abnormalities, behavioral problems, and mental impairment in life.[30,31]

Some birth deformities that may also be correlated with FAS discussed in turn below.

Renal deformities: Infants with FAS has had documented renal acidification impairment. Zinc deficiencies occurred in neonates with FAS because of more urinary zinc excretion could exhaust the zinc stores of the body. Fetal dysmotphogenesis may be influenced by zinc deficiency occurred during pregnancy in women. Women who intake moderate amount of alcohol during their 1st trimester of pregnancy perhaps elevated their risk of giving birth to an infant with rarely kidney defects. Bilateral renal agenesis is occurred during the second month of pregnancy; if the pregnant women consume alcohol heavily. The deformities of renal abnormalities demonsterated from prenatal alcohol exposure are plastic kidneys, cross-fuse ectopia, urethropelvic junction obstruction, dysplastic kidneys, ureteral duplications, hypoplastic kidneys, hydronephrosis, and horseshoe kidneys.[32]

Atopic dermatitis: Elevated risk of atopic dermatitis in early neonate that resolved during childhood can associated with heavy alcohol consumption during pregnancy. The atopic dermatitis mainly occurred when the two parents had allergic disease. The greatest risk was seen in great-risk infants of mothers who drunken four or more drinks per wk (binge drinking) at thirty wks of gestation. Heavy alcohol consumption by pregnant women with a history of bronchial asthma is importantly correlated with an elevated risk for the child advancing atopic dermatitis during the 1st seven years of life.[32,33]

Oro-facial clefts: Women who drunken high amount of alcohol during the first wks of the pregnancy have more likely a baby with a cleft lip or cleft palate than other women. Folic-acid supplementation multivitamins are used to certain of the women who didn't modify the correlation between oral clefts and ethanol drunken. The facial characteristics of fetus with fetal alcohol syndrome are small head circumference, epicanthal folds, small palpebral fissures, flat nasal bridge and midface, upturned face, thin upper lip, and a smooth philtrum.[32,34,35]

Cardiac anomalies: A congenital cardiac challenge has been seen in 1/3rd of pediatric with alcohol embryopathy and is the leading noninfectious cause of death in the 1styear of life. Alcohol abuse and addiction during pregnancy can induce injury of heart muscle and heart deformity in the offspring. The deformity of cardiac abnormalities demonsterated from prenatal alcohol exposure are deformities of atrial septal defects, aberrant great vessels, ventricular septal defects, tetralogy of Fallot, hypoplastic nails, clinodactyly, shortened fifth digits, pectus excavatum and carinatum.[32, 36–38]

Behavioral and developmental changes: Alcohol can be thought-out only of the risk factors for ADHD, independently of prenatal nicotine exposure or other familial risk factor. Pediatric with FAS usually reveal socially inappropriate behavior due to impaired practical reasoning skills and have central nervous system problems, growth problems and minor facial features. Deformities in social behaviors in children with FAS are more severe than those seen in children with identical verbal intelligence quotient (IQ); but who were not endangered to alcohol. Additionally, social behavior deformities have been correlated with prenatal alcohol exposure in adolescents and adults without the full FAS diagnosis and at lesser doses of alcohol than would be necessary to generate the full FAS. Poorer cognitive and behavioural effects are correlated with larger brain volume decreases from PAE; however, rates of brain volume growth are identical in early childhood and there are abnormal brain-behaviour connections displayed in pediatric with PAE.[32, 39–42]

Psychiatric disorders: Adults endangered to heavy alcohol consumption while in utero were resulted to have elevated rate of somatoform disorders, substance dependence, paranoid, passive aggressive, anti-social and other personality disorders. Fetal vulnerability to alcohol perhaps generate brain injury, itself correlated with elevated liability for schizophrenia and because chronic exposure to alcohol perhaps lead to a symptomatic schizophrenic illness. Fetal alcohol syndrome results in cognitive difficulties, intellectual disabilities, learning difficulties, difficulties of executive functioning and inefficient brain processes leading to less flexible and adaptive social information processing and emotional regulation.[32–43]

Neural tube defects: Maternal heavy alcohol drinking in early pregnancy was resulted to be related to elevated risk of neural tube defects. NTDs were happened when the neural tube fails to close during early gestation is certain of the most common birth deformities worldwide. Neural tube defects can be described by a sack of fluid that protrudes through an opening baby's back, spinal bifida, anencephaly, and nerve damage (Table 1).[32, 44,45]

Table 1 Summary of fetal alcohol syndrome birth defects

Birth defects	Characterized by
Renal abnormalities	plastic kidneys, cross-fuse ectopia, urethropelvic junction obstruction, dysplastic kidneys, ureteral duplications, hypoplastic kidneys, hydronephrosis, and horseshoe kidneys
Cardiac deformities	atrial septal defects, aberrant great vessels, ventricular septal defects, tetralogy of Fallot, hypoplastic nails, clinodactyly, shortened fifth digits, pectus excavatum and carniatum
Oro-facial clefts	small head circumference, epicanthal folds, small palpebral fissures, flat nasal bridge and midface, upturned face, thin upper lip, and a smooth philtrum
Atopic dermatitis	Itchy, dry skin or rash, redness and inflammation of the skin
Behavioral and developmental disturbances	Socially inappropriate behavior, impaired practical reasoning skills, central nervous system problems, growth problems and minor facial features
Psychiatric disorders	Cognitive difficulties, intellectual disabilities, learning difficulties, difficulties of executive functioning and inefficient brain processes
Neural tube defects	Sack of fluid that protrudes through an opening baby's back, spinal bifida, anencephaly, and nerve damage

Conclusion

Many adverse health effects for the developing fetus such as intrauterine growth retardation, low birth weight, learning disabilities,

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behavior problems, spontaneous abortion, structural malformations, pre- and post-natal growth retardation, central nervous system damage, and neurodevelopmental abnormalities and fetal alcohol syndrome are correlated with maternal alcohol consumption during pregnancy. Alcohol readily crosses the placenta and affects the fetal development directly; if drunken during pregnancy and eventually alcohol drunken during pregnancy may change fetal advancement indirectly by disrupting the normal hormonal interactions between the mother and the fetus. The level of effects of alcohol usage during pregnancy perhaps different based on the frequency of exposure to alcohol, dose, duration, genetic factors, maternal nutrition, and developmental stage of the fetus at exposure. The deformity of cardiac abnormalities demonsterated from prenatal alcohol exposure are deformities of atrial septal defects, aberrant great vessels, ventricular septal defects, tetralogy of Fallot, hypoplastic nails, clinodactyly, shortened fifth digits, pectus excavatum and carniatum.

Data Sources: Sources searched include Google Scholar, Research Gate, PubMed, NCBI, NDSS, PMID, PMCID, and Cochrane database. Search terms included: alcohol intake during pregnancy and fetal alcohol syndrome.

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Conflicts of interests

The author declares no conflicts of interest.

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