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Maternal alcohol consumption & prevention of congenital heart defects

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Objective

The aim of this study was to investigate the CHD due to alcohol consumption during and before pregnancy and effective prevention measures.

Methods

This study is a systematic review study. In this study search was performed of the following databases: Google Scholar, PubMed, Cochrane Register of Controlled Trials, EMBASE, and MEDLINE. Relevant articles were reviewed. Key components were elicited: FASD, PEA, alcohol, CHD, Folic acid, selenium, Zinc, copper, drinking and dietary habits.

Results

Studies would indicate that SHF cells are somehow uniquely susceptible to alcohol-induced teratogenicity. Endocardial to mesenchymal transformation (EMT) plays a critical role in the development of both atrioventricular and semilunar valves. The atrioventricular valves are formed by both FHF and posterior SHF cells. Endocardial cushion defects have been observed in an animal model of prenatal alcohol exposure in which alcohol exposure was targeted to the timepoint when SHF progenitors begin specification (between embryonic days 6 and 7) and are most vulnerable. Mechanism of the effect of alcohol on the increase of the CHD include: serotonin reuptake inhibitors and lithium, oxidative stress, folate deficiency, decreased serum selenium levels, decreased plasma zinc levels in mother and Infant, reducing uterine arterial blood flow, malabsorption of vitamin B12, homocysteine metabolism& DNA methylation. the most common CHD lesions in FASD 1- Endocardial cushion defects (atrioventricular valve impact, atrial -ventricular septal defect) 2- Pulmonary valve abnormalities (semilunar valve impact & congenital stenosis of the aortic valve Some studies have reported that the most common cardiac abnormality associated with alcohol consumption is Fallot tetralogy which More specifically, the offspring exposed to maternal alcohol consumption in 3 months before pregnancy have the highest increased risk. Effective measures and prevention Folic acid CHD is considered a folic acid-sensitive birth defect because women who take folic acid-containing multivitamins early in pregnancy have a 80-90% lower risk of having offspring with these heart defects. Folic acid is an essential B vitamin that the human body cannot synthesize; it can only be obtained from the diet. Studies have shown that folic acid plays an important role in embryonic development, including the development of the cardiovascular system. If folic acid is metabolically disordered, it will cause the methionine cycle to be blocked. On the one hand, it affects the methylation reaction in the body, which in turn affects the metabolic growth of cells. On the other hand, it causes the metabolic disorder of homocysteine (Hcy) in the blood, which leads to an increase in Hcy levels. Elevated Hcy is an independent risk factor for cardiovascular disease, which can damage or interfere with early cardiovascular growth and development. If the metabolism of folate is affected, deoxyribonucleic acid synthesis and repair will be impaired, and the development of the neural crest in the embryo will be abnormal, which will eventually lead to the occurrence of CHD. ZINC Possible Mechanisms Zinc is involved in the synthesis of many lipids, nucleic acids, and proteins. Zinc deficiency could induce alterations in the distribution of connexin-43 and HNK-1 in fetal hearts and result in the occurrence of heart anomalies. Zinc deficiency could also activate apoptotic and inflammatory processes and decrease TGF-β1 expression and nitric oxide synthase activity in cardiac tissue. Zinc supplementation was reported to significantly downregulate protein and mRNA expression of metallothionein in the developing heart of embryos and decreased apoptosis and reduced levels of reactive oxygen species. Copper Copper ions serve as an important catalytic cofactor in the redox chemistry of proteins exerting fundamental biological functions, such as cytochrome C oxidase, Cu/Zn superoxide dismutase, and ceruloplasmin. With a relatively high DNA binding affinity, copper may displace zinc ions in zinc-finger transcription factors and interfere with their functions in fetuses. Inhibition of zinc-finger transcription factors, such as GATA4 and Zac1, could lead to embryonic lethality, thin ventricular walls, or abnormal looping morphogenesis of the primary heart tube (0.9 mg/d). Selenium Selenium is essential for antioxidant enzyme activities and normal fetal development Selenium deficiency in pregnancy might contribute to congenital anomalies, including neural tube defects and orofacial clefts Selenium exposure was reported to be associated with the changes in epigenetic patterning in both human and animal studies which may exert effects on fetal cardiovascular development. Drinking and dietary habits Also based on the opinions of traditional medicine practitioners in Iran, China and Greece, observing some of the drinking and dietary habits can reduce the harmful effects of alcohol such as: avoiding drinking alcohol in fasting, hunger and along with food, drinking alcohol after fully digestion, having drinkable vinegar after alcohol intake, using cold water, yogurt, pomegranate, olive, vinegar-mint, having fat and carbohydrate foods along with drinking alcohol and low mobility. Preventive measures 1- women of childbearing age should supplement with folic acid as early as possible, ensuring coverage of the critical window for fetal heart development to prevent CHDs. Especially from three months before pregnancy to the first trimester of pregnancy. 2- Regular multidisciplinary team care in a nonjudgmental environment facilitated mother engagement in antenatal and neonatal care. 3- Early engagement in antenatal care and in alcohol use intervention increase chances of alcohol consumption and lifestyle improvement. 4- Multivitamin/mineral supplements include vitamin A, the omega-3 long chain polyunsaturated fatty acid, docosahexaenoic acid (DHA), folate, zinc, choline, vitamin E, selenium, riboflavin, calcium, B-vitamins, vitamin C, iron and protein, soy isoflavones, may reduce the risk of FASD-relevant outcomes. 5- A diet rich in prebiotics and probiotics may help reduce alcohol related disorders and reduces the harmful effects of alcohol use. 6- Educational programs to minimize tobacco and alcohol exposure, not only during pregnancy, but also during the peri-conceptional period. 7- Pregnancy and motherhood are powerful motivators to stop or reduce alcohol use.

Conclusion

Please stop alcohol consumption during pregnancy & 3 month before pregnancy. Folic acid intake from 3 months before pregnancy and the first trimester is a golden key to a healthy fetus.