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Risk of Endocrine Disrupting Chemical Bisphenol A Exposure in Gestational Diabetes Mellitus Patients: A Clinical Update

Balaji Vijayam[1]*, Taarika Balaji[2], Madhuri S Balaji[1], Setia Veerasamy[1] and Vinoth kumar Ganesan[3]

[1]*Department of Diabetology, Dr V Balaji Dr V Seshiah Diabetes Care and Research Institute, India*

[2]*Department of Medicine, Saveetha Institute of Technical and Medical Sciences, India*

[3]*Department of Medical Research, Dr V Balaji Dr V Seshiah Diabetes Care and Research Institute, India*

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***Corresponding author:** Balaji Vijayam, Department of Diabetology, Dr. V Balaji Dr. V Seshiah Diabetes Care and Research Institute, India

Abstract

Food contact materials and personal care products expose women to non-persistent endocrine disrupting chemicals (EDCs). Understanding the effects of these chemicals on pregnancy and long term health outcomes in women is a crucial field of research that has largely gone unexplored. Bisphenol A (BPA) is one of the most common EDCs on the market. It is utilised as a starting material in the creation of polycarbonate and other plastics found in a wide range of consumer products. BPA is persistently present in human bodies, and as a result, it has been discovered in the vast majority of those tested. An expanding body of studies has provided significant support for the role of BPA in the genesis of GDM during the last decade. GDM is associated with disabling and potentially life threatening complications including obesity, cardiovascular disease, malignancies, delivery trauma, hypoglycemia, preeclampsia and eclampsia. According to recent study, BPA binding to pancreatic islet cells might impede insulin or glucagon release, resulting in insulin resistance. Adult mice exposed to modest doses of BPA developed hyperinsulinemia and insulin resistance, which are linked to pancreatic beta cell failure. This review focuses on the epidemiology research that looks at the links between non-persistent BPA and maternal pregnancy outcomes and women with GDM.

Keywords: Plastics; Bisphenol A; insulin resistance; GDM

Introduction

India has long been known as the world's diabetic capital, and gestational diabetes mellitus (GDM) is a much worse problem in India than it is elsewhere. It is commonly accepted that diabetic women, especially pregnant and lactating women, are among the most vulnerable [1]. India is the world's most populous democratic country, with 16 percent of the world's population. Unfortunately, with 45,000 maternal deaths in 2015, India has the highest maternal mortality rate in the world. It is one of six countries responsible for half of all maternal deaths worldwide [2] In comparison to other Asian nations. Bisphenol A (BPA, 2, 2-bis (4-hydroxyphenyl)-propane) is a chemical that is found in polycarbonate plastics, epoxy resins, and thermal paper. It's one among the most widely manufactured substances in the planet. Because of its extensive use and probable toxicity, BPA is a significant environmental health concern [3]. BPA is an estrogen-mimicking endocrine disruptor. BPA may influence circulating hormone levels, cardiovascular health, obesity, reproductive health in both men and women, hormone-driven malignancies, and children's neurobehavioral development, according to evidence [4]. According to recent epidemiological studies, BPA may raise the incidence of insulin resistance and type 2 diabetes (T2DM). BPA exposure during pregnancy has been linked to the development of GDM, which is a precursor to T2DM in women [5]. The focus of this review is on epidemiologic studies that look at the relationship between non-persistent BPA and maternal pregnancy outcomes in GDM women.

The pathophysiology of gestational diabetes mellitus

The biochemistry of gestational diabetes is still a mystery. Insulin resistance is one of the fundamental characteristics of the underlying condition, in which the body's cells fail to respond correctly to the hormone insulin. Several pregnancy hormones have been shown to disrupt insulin's normal action as it connects

to its receptor, most likely via cell signaling pathways. Insulin is produced in the beta cells of the Langerhans islets in the pancreas. Insulin is necessary for the body's blood glucose control. Insulin stimulates the absorption of glucose from the blood by skeletal muscle and adipose tissue cells. In the presence of insulin resistance, this blood glucose uptake is impeded, resulting in a high blood sugar level [6]. The body compensates for the resistance by producing more insulin, which in gestational diabetes can be 1.5 to 2 times higher than in a normal pregnancy. The GLUT1 carrier enables blood glucose to pass through the placenta and reach the baby. If the foetus is not treated for gestational diabetes, the foetus is exposed to an excessive amount of glucose, causing the foetus to produce more insulin. Insulin increases growth, so the infant grows larger than expected for their gestational age [6].

BPA exposure during gestational period

BPA is easily released from these products, resulting in widespread human exposure [7], predominantly through diet [8,9], with > 90% of persons having measurable levels of BPA in their urine [8,9]. Yunzhen, et al. [10] discovered that maternal serum BPA in the first half of pregnancy was strongly connected to an elevated risk of pre-eclampsia, suggesting that limiting BPA exposure during pregnancy could be a feasible way to preventing pre-eclampsia [10]. Recent research has shown that BPA can accumulate in the placenta [11,12] and cause toxic effects in placental cells [13-15], which could be linked to aberrant placental development and pregnancy outcomes such pre-eclampsia. Current epidemiological evidence for a link between maternal BPA exposure and pre-eclampsia is, however, limited [16,17]. When compared to normotensive controls, pre-eclampsia women had higher BPA contents in the placenta at delivery [17] and in urinary samples at early pregnancy [16].

BPA exposure during gestational diabetes

Pregnancy causes major changes in glucose regulation, including insulin resistance and increased maternal glucose output. Gestational diabetes usually occurs when insulin secretion does not grow enough to combat insulin resistance. This can result in additional metabolic difficulties for both the mother and the foetus, including an increased risk of T2DM later in life [18,19]. The effects of EDCs on pregnant women have been extensively researched. BPA can be transferred from mother to offspring through the placenta and breast milk, according to studies [20], however there is no evidence that BPA exposure affects GDM serum levels. Because estrogen is required for the regulation of maternal responses to pregnancy, xenoestrogens like BPA are likely to disrupt these processes. Pregnancy and the post-partum period might be viewed as a critical window of exposure during which EDCs can cause severe harm to both the mother and the foetus [21].

Future directions and challenges

In conclusion, it was not possible to demonstrate a link between BPA exposure and the development of GDM in this small review study. To determine if environmental pollutants like BPA play a role in the etiology of GDM patients, larger clinical research investigations are required. The use of repeated specimen collection to quantify BPA during etiologically relevant windows for GDM and other outcomes of concern would improve exposure assessment in future research. Environmental exposures that may have an impact on the health of vulnerable groups, such as pregnant women and their children, should be investigated.

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