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Commentary

Plastic compounds and liver diseases in pediatrics: Navigating the hazards

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Background

Recent research underscores the risk posed by plastic compounds to pediatric liver health. These compounds can permeate the maternal-fetal-child barrier through the placenta and breastfeeding, exposing fetus/child to potential harm during crucial developmental stages [1,2].

The presence of elevated levels of heavy metals and phthalates in children's toys more than prescribed limits raised a serious concern about the health and safety of the children [3]. Owing to multiple reports and studies related to plastic contaminants, pediatricians are finding it difficult to practically avoid this added burden to an already rising spectrum of non-communicable diseases [4].

Bisphenol A and Liver Health

Recent studies have unearthed the adverse effects of Bisphenol A (BPA), a ubiquitous plasticizer, on pediatric liver health [5]. BPA commonly found in food containers and packaging has been linked to disruptions in liver function with implications for metabolic health [6]. Similarly, another Bisphenol Analogue, BPS is found to be of equal or more harm [7]. Higher than the acceptable limits of BPA were detected in children which is associated with raised liver enzymes suggesting liver dysfunction [8]. New evidence suggests a correlation between early life BPA exposure and an increased risk of non-alcoholic fatty liver disease (NAFLD) in pediatric populations [9].

Phthalates and Hepatic Consequences

Phthalates, another class of plasticizers, have been under scrutiny for their potentially harmful effects on children affecting their overall growth and development [10,11]. These plastic associated endocrine-disrupting chemicals (EDCs) like phthalates and phenols are associated with increased risk of liver injury [12]. Early life exposure to phthalates increases insulin sensitivity and lipid levels in children leaving them prone to development of NAFLD at a later stage [13]. Frequently used plasticizer, di-(2-ethylhexyl)-phthalate (DEHP) which is used with polyvinylchloride (PVC) is prominently contaminating the surroundings. Its long-term toxicity can leave considerable risk to pregnant women and children [14]. Long-term implications of DEHP leaching out of medical instruments/tubings used in pediatric ward patients undergoing various treatments cannot be ruled out [15,16]. Because of this, the measures to minimize exposure of phthalates to critically ill children are in talks [16]. The frequent exposure of these plastic leachates (e.g. EDCs) that children are exposed to leads to adverse effects in pubertal children [17].

Microplastics and Liver Impact

Microplastics are degraded plastics of <5 mm that can enter biological systems through various routes [18]. The advent of microplastics in our daily lives has raised concerns about their impact on pediatric health [19]. Their ominous presence affects children's health in myriad ways through

immunomodulation [20]. Recent investigations highlight the presence of microplastics in infant formula and baby food opening a discussion on the potential long-term hepatic consequences of early exposure to these microscopic plastic particles [21,22]. Microplastics with exposure equivalent to humans were able to cause steatosis in the liver of rat pups accompanied by oxidative stress and inflammation [23]. Further an altered gut-liver axis can induce insulin resistance in children [24].

Addressing the Crisis/ Green Solutions

Since its mass production, gross mismanagement of plastics has resulted in the inability to maintain a circular cycle to its end of life [25]. Sustainable/environment-friendly materials are the need of the hour to save our future generations from the ill effects of deplorable plastics. Biodegradable/recyclable materials offer promise, but their widespread adoption requires careful evaluation of economic viability and applicability compared to synthetic options [26,27]. Government intervention and incentives are crucial to drive the transition towards green solutions and establish a circular lifestyle for plastics thereby safeguarding the health of future generations [28,29].

Conclusion

In conclusion, the interplay between plastic compounds and liver diseases in the pediatric population is an evolving area of research with significant implications for public health. Recent research raises concern that micro nano plastics (MNPs) can pose a threat even to fetal health [30]. Phthalate (a plastic pollutant) in childhood can pose a threat to hepatic health in adolescence [31]. Therefore, it is understandable that recent researchers are interested in digging out the effects of plastic pollution on child health. Despite considerable current interest in the field, the potential confounders and effect modifiers are not accounted for across the studies that are available to date. At present, adequate evidence of plastic pollutant-induced toxicities is not documented in the pediatric population. So, continuing research and systematic reviews in the field are urgently required to understand the matter from a holistic perspective. We believe that more research is necessary to establish the causality and mechanism of action of the plastic pollutants negatively affecting children's health. On a priority basis, the extent of plastic pollution should be understood in the pediatric population with a thrust to understand the mechanism of toxicity. Adopting the most sensitive and accurate methodologies on date (for example MS-based) plastic pollutants like bisphenols, phthalates etc., should be assessed in the pediatric population, and in children the occurrence of diseases should be correlated with the result of such experiments. We believe that biochemists, toxicologists, public health experts, and clinicians should join hands to do such research since without multidisciplinary efforts the proposed project will not see the light of the day. We recommend the funding agencies consider urgent funding for this kind of project since without creating the proposed database it is impossible to formulate appropriate policies to curtail the menace.

This commentary has provided an overview of recent updates in the field and critically analyzed the issues addressed in the focal article. As we move through this complex area of environmental exposures and pediatric health, it is essential to continue improving our understanding of the mechanisms at play and approaching the measures to mitigate the potential risks posed by plastic compounds. Analyzing the focal article's discussion on policy implications, it is paramount to advocate for change on a broader scale. This involves the recommendations for regulatory measures, public awareness campaigns, and political shifts in pediatric healthcare practices.

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