HEAVY METALS – GUT MICROBIOME INTERACTIONS

Shankar Bolan[1], B Seshadri, R Naidu, N Talley

[1]Global Centre for Environmental Remediation (GCER), University of Newcastle, Newcastle, Australia

[2]Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), ATC Building, Callaghan NSW 2308, AUSTRALIA

Shiv.Bolan@uon.edu.au

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INTRODUCTION

The human gut harbors diverse microbes that play a significant role in the well-being of their host and create a pathway for interaction with environmental contaminants. The human body carries about 100 trillion microorganisms in its intestines, a number ten times greater than the total number of human cells in the body (Guarner and Malagelada 2003). It is increasingly being recognised that individual variations in the gut microbiome can influence host health and this may be implicated in disease etiology, and drug metabolism, toxicity, and efficacy and interaction with environmental contaminants. Environmental contaminants including heavy metals have been shown to impact the functional and genomic diversity of microbiomes (Kostic et al., 2013). However, the molecular basis of microbe–host and contaminant-microbe interactions, the functional distribution and diversity, and the roles of individual bacterial species are not well known. In this paper we present an overview of human gut microbiota, their role in defining human health and potential impact of contaminants on gut microflora.

ROLE OF GUT MICROBIOTA IN HUMAN HEALTH

The gut microbiota play a critical role in maintaining normal physiology and energy production. Other functions gut microbiota at least in part influence include, metabolism, immune system training, vitamin production, body temperature regulation, and tissue growth. Gut microbes can also significantly affect human behaviour and health status by exerting control over the development and function of our physiological systems (e.g., immune, gastrointestinal and neurological) (Berk et al. 2013). Interruption of this microbial system or 'dysbiosis' is thought to result in several disease states including inflammatory bowel disease, colon cancer, irritable bowel syndrome, gastric ulcers, liver disease, obesity and metabolic syndromes. Hence, there is a need for overall balance in the composition of the gut microbial community. The presence or absence of key gut microbe species will not only elicit specific metabolic responses but also play an important role in ensuring homeostasis of the entire gut (Sekirov et al., 2010).

GUT MICROBIOTA - ENVIRONMENTAL CONTAMINANTS INTERACTIONS

The gut microbes not only can be affected by environmental contaminants but they themselves can alter the speciation and bioavailability of these contaminants. This creates somewhat of a two way interaction between microbiome and contaminants. Gut microbes or microbial diversity and function being impacted by contaminants and the contaminants being transformed or impacted by gut microbes. These interactions can have a variety of consequences for the host and the contaminant.

Gut Microbes can affect the way toxic compounds react with the human host. For example, Van de Wiele et al. (2010) have shown that the bioavailability of arsenic ingested through arsenic contaminated rice from China is likely to be altered as it moves through the digestive system. The ability of the human microbiome to methylate and demethylate arsenic is important due to the implications for the toxicity profile for arsenic and the chronic health outcomes related to arsenic exposure.

New evidence is showing that the ability of the human microbiome to methylate inorganic mercury and demethylate methylmercury is challenging our current thinking about the exposure assessments for mercury (Laird et al. 2013). Historically regulations have focused mainly on human exposure to methylmercury, but since our microbes may help to expose us to inorganic mercury which has a toxicity higher than methylmercury, this now has implications surrounding the current regulations.

In this paper we present an overview of human gut microbiota, their role in defining human health and potential impact of heavy metals on gut microbiota.

CONCLUSION

This overview highlights our understanding of the complex interaction between gut microbes and environmental contaminants. Heavy metals can affect the diversity and functions of the gut microbiome and gut microbes in turn could transform heavy metals species that reach our gastro intestinal tract.

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