REVIEW ARTICLE

Check for updates

Reconciling Hygiene and Cleanliness: A New Perspective from Human Microbiome

Vipin Gupta^{1,4} • Roshan Kumar² · Utkarsh Sood³ · Nirjara Singhvi⁴

Received: 18 September 2019/Accepted: 3 November 2019/Published online: 12 November 2019 © Association of Microbiologists of India 2019

Abstract The term hygiene is deeply rooted with the concept of maintaining sound health and alertness towards cleanliness, while "hygiene hypothesis" depicts the protective role of microbial community exposure in development of early immunity and initial allergic and aesthetic reactions. The tug-of-war has now been pushed toward the literal term "hygiene" over the "hygiene hypothesis" and has continued with disinfection of all microbial loads from the related environments to avoid infections in humans. With the advancement in the microbiome studies, it became clear that humans possess warm, and significant relationships with diverse microbial community. With this opinion article, we have emphasized on the importance of hygiene hypothesis in immunological responses. We also propose the individual/targeted hygiene instead of application of unanimous hygiene hypothesis. This review also elaborates the common practices that should be employed to maintain hygiene along with the balanced microbiome.

Vipin Gupta, Roshan Kumar and Utkarsh Sood have contributed equally to this work.

Vipin Gupta vipinguptadu@gmail.com

- ¹ PhiXGen Private Limited, Gurugram, Haryana 122001, India
- ² P.G. Department of Zoology, Magadh University, Bodh-Gaya, Bihar 824231, India
- ³ The Energy and Resources Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi 110003, India
- ⁴ Department of Zoology, University of Delhi, Delhi, Delhi 110007, India

Keywords Hygiene \cdot Old friend hypothesis \cdot Targeted hygiene \cdot Allergies

Introduction

The human microbiome is one of the most studied microecosystems representing the symbiotic association of microbes with the body cells. It has been estimated that the human gut harbors approximately 40,000 bacterial species, 9 million inimitable bacterial genes and 100 trillion microbial cells [1-3]. Not only bacteria, but also archaea, fungi, viruses and protozoa contribute to the human microbiome. In the recent years, the in-depth microbiome analysis have revealed that the microbiome is a crucial determinant of our protective immune responses and helps in proper functioning of digestive system, endocrine system as well as nervous system [4-7]. With the advancements in human microbiome research it is becoming increasingly clear that all bacteria are not dangerous and the concept that we should avoid bacteria at all cost i.e., the conflating hygiene with sterilization is proving to be utterly wrong [8]. On the other hand, the hygiene concept is primarily rooted around cleanliness for maintaining the healthy lifestyle. The effect of several factors such as physical, psychological, social, diet, different ancestral origin and hormonal cycles on the human microbiome are in direct influence of hygiene and it has now become an essential directive for microbiome assessment [9–11]. People often conflate hygiene with sterilization, which means the removal of microbes irrespective of their roles. Thus, promoting the healthy microbial diversity should add into the hygiene hypothesis, rather than conflicting it. In this review, we have focused on the key hygiene factors which directly or indirectly in linkage with our microbiome.