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EDITORIAL

Women health and microbiota: Different aspects of well-being

Giulia Nannini, Amedeo Amedei

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Giulia Nannini, Amedeo Amedei, Department of Experimental and Clinical Medicine, University of Florence, Florence 50134, Italy

Amedeo Amedei, Network of Immunity in Infection, Malignancy and Autoimmunity (NIIMA), Universal Scientific Education and Research Network (USERN), Florence 50134, Italy

Corresponding author: Amedeo Amedei, MSc, Full Professor, Department of Experimental and Clinical Medicine, University of Florence, 3 Largo Brambilla, Florence 50134, Italy. amedeo.amedei@unifi.it

Abstract

In this editorial, we comment on the article by Marano *et al* recently published in the *World Journal of Gastroenterology* 2023; 29 (45): 5945-5952. We focus on the role of gut microbiota (GM) in women's health, highlighting the need to thoroughly comprehend the sex differences in microbiota. Together, the host and GM support the host's health. The microbiota components consist of viruses, bacteria, fungi, and archaea. This complex is an essential part of the host and is involved in neurological development, metabolic control, immune system dynamics, and host dynamic homeostasis. It has been shown that differences in the GM of males and females can contribute to chronic diseases, such as gastrointestinal, metabolic, neurological, cardiovascular, and respiratory illnesses. These differences can also result in some sex-specific changes in immunity. Every day, research on GM reveals new and more expansive frontiers, offering a wealth of innovative opportunities for preventive and precision medicine.

Key Words: Gut microbiota; Women; Immune system; Well-being; Hormones; Sex-differences

Core Tip: The intestinal microbiota, comprising viruses, bacteria, fungi, and archaea, plays a crucial role in neurological development, metabolic control, immune system dynamics, and overall host homeostasis. Differences in gut microbiota between males and females are suggested to contribute to various chronic diseases, including gastrointestinal, metabolic, neurological, cardiovascular, and respiratory illnesses, as well as sex-specific changes in immunity. The editorial highlights the ongoing research in the field, revealing new opportunities for innovative approaches in preventive and precision medicine.

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INTRODUCTION

The human body is home to symbiotic bacteria in a variety of sites that support a healthy organism's function. In detail, the gut contains trillions of microorganisms that make up the highly complex and diverse gut microbial kingdom. These microorganisms include bacteria, fungus, viruses, and archaea[1]. As a vital host component, this complex plays a key role in immune system maintenance and dynamics, metabolic regulation, host dynamic homeostasis, and neurological development[2].

The human body and its native microbiota have a strict symbiotic relationship that begins at birth. This interaction is essential to preserving general health and wellbeing. The microbiota is involved in the regulation of metabolic, endocrine, and immune processes and in influencing drug metabolism and absorption[3]. Progesterone, estrogen, and testosterone are examples of sex hormones that have a variety of physiological functions in reproduction, differentiation, cell division, apoptosis, inflammation, metabolism, homeostasis, and brain function. In addition, the sex hormones play a part in communication between microorganisms and their hosts[4]. In essence, hormones generated by commensal bacteria can influence human behavior, immunity, and metabolism through their interactions with microorganisms[5].

In this editorial we comment on the article published by Marano *et al*[6] in the recent issue of the *World Journal of Gastroenterology* 2023. Specifically, the article focused on the emerging role of gut microbiota (GM) in the different women phases of life. Studies on animals have shown that the mother's microbiota during pregnancy affects the development of the fetal brain and the behavior of the postnatal period[7,8]. Predominant opinion holds that the mother's GM, given to the child at birth, regulates the offspring's gut-brain axis, which is developed postnatally and is based on the concept of a sterile womb[9]. However, increasingly a small number of specific bacteria are being discovered in fetuses that could be considered transitional species facilitating the development of an adequate microbiota after birth[10].

Anyway, the human microbial colonization process starts, in part, at birth and lasts for around three years, during which time it develops and changes in species abundance until the microbiota resembles that of an adult. The diversity and richness of gut bacteria continue to react quickly to dietary changes in infants during the first year of life and the introduction of solid foods modifies the gut bacteria's metabolic activity[11]. Sex-dependent differences in the gut microbiome have been reported and the overall composition of the gut microbiomes of men and women is notably different[12,13]. It is well known that differences in the GM of males and females can drive chronic diseases, ranging from gastrointestinal inflammatory and metabolic conditions to neurological, cardiovascular, and respiratory illnesses. These differences can also result in some sex-specific changes in immunity.

Sexes inequalities are becoming more and more relevant in the pathophysiology, epidemiology, and treatment of many diseases, particularly non-communicable diseases[14]. Nonetheless, despite the fact that women make up over half of the population, there has been documented disparity in how the sexes are presented in health research[15]. Although the appropriate definition of a healthy gut microbiome is still unknown, a number of diseases have been linked to gut microbial dysbiosis and the female GM is a subject that deserves further research.

Studies on both animals and humans revealed sex-related changes in GM, albeit the results are contrasting[16-18]. In detail, animals' models, primarily mice, have unequivocally demonstrated sex-specific variations in GM composition. Recently Stapleton *et al*[19] described the variations in sex-related weight gain, plasma lipid profiles, composition of the faecal microbiota, and levels of faecal short chain fatty acids. When given the same high-fat diet, they observed that male mice acquired significantly more weight than female mice. Nevertheless, after receiving antibiotics to deplete the microbiota, sex differences remained.

However, the principal component analysis in a study conducted in 2005 on 91 northern Europeans subjects from France, Denmark, Germany, the Netherlands, and the United Kingdom using fluorescent in situ hybridization with 18 phylogenetic probes, revealed no significant differences in the colonic microbiota between the sexes[20]. Whereas, an additional research, published in 2006 and including four centres in France, Germany, Italy, and Sweden, found that males showed higher amounts of the Bacteroides-Prevotella group[18].

In 2014, researchers who analyzed a 16S rRNA gene sequence data set from the Human Microbiome Project Consortium, simply reported that sex was associated with the community types identified in the stool. In detail, males were three times more likely to have community type D, with fewer *Bacteroides* and higher *Prevotella*[3]. A very recent Japanese study[21] examined sex-related differences and potential causes, analyzing and comparing the GM compositions of males and females throughout a broad age range. The authors did not observed difference between GM relative abundances or alpha diversities between men and women at any age. However, they showed that the GM heterogeneity among women in their 20s was greater than in men.

CONCLUSION

In this scenario, the manuscript of Marano *et al*[6] appears very interesting since gave us lots food for thought to deeply

understand the relationship between women microbiota composition and not only physical but also psychological well-being. Finally, considering the relevance of the microbiota differences in sexes and the linked-consequences such as immune and metabolic disorders, we think that it could be useful deeply analyze the microbiota functional activities, focusing on metabolites such as short-chain fatty acids, amino acids, and lipids, to improve the diagnosis of some diseases and suggest new therapeutic approaches shaping the microbiota composition and function.

FOOTNOTES

Author contributions: Nannini G and Amedei A designed the overall concept and outline of the manuscript; Nannini G and Amedei A contributed to the writing, and editing the manuscript; Nannini G reviewed the literature; Amedei A supervised and revised the manuscript; both authors have read and approve the final manuscript.

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Country/Territory of origin: Italy

ORCID number: Giulia Nannini 0000-0002-6481-6864; Amedeo Amedei 0000-0002-6797-9343.

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REFERENCES

1 **Sender R**, Fuchs S, Milo R. Revised Estimates for the Number of Human and Bacteria Cells in the Body. *PLoS Biol* 2016; **14**: e1002533 [PMID: 27541692 DOI: 10.1371/journal.pbio.1002533]
2 **Erny D**, Hrabě de Angelis AL, Jaitin D, Wieghofer P, Staszewski O, David E, Keren-Shaul H, Mahlakoiv T, Jakobshagen K, Buch T, Schwierzeck V, Utermöhlen O, Chun E, Garrett WS, McCoy KD, Diefenbach A, Staeheli P, Stecher B, Amit I, Prinz M. Host microbiota constantly control maturation and function of microglia in the CNS. *Nat Neurosci* 2015; **18**: 965-977 [PMID: 26030851 DOI: 10.1038/nn.4030]
3 **Ding T**, Schloss PD. Dynamics and associations of microbial community types across the human body. *Nature* 2014; **509**: 357-360 [PMID: 24739969 DOI: 10.1038/nature13178]
4 **Edwards DP**. Regulation of signal transduction pathways by estrogen and progesterone. *Annu Rev Physiol* 2005; **67**: 335-376 [PMID: 15709962 DOI: 10.1146/annurev.physiol.67.040403.120151]
5 **Martinelli S**, Nannini G, Cianchi F, Staderini F, Coratti F, Amedei A. Microbiota Transplant and Gynecological Disorders: The Bridge between Present and Future Treatments. *Microorganisms* 2023; **11** [PMID: 37894065 DOI: 10.3390/microorganisms11102407]
6 **Marano G**, Traversi G, Gaetani E, Gasbarrini A, Mazza M. Gut microbiota in women: The secret of psychological and physical well-being. *World J Gastroenterol* 2023; **29**: 5945-5952 [PMID: 38131001 DOI: 10.3748/wjg.v29.i45.5945]
7 **Buffington SA**, Di Prisco GV, Auchtung TA, Ajami NJ, Petrosino JF, Costa-Mattioli M. Microbial Reconstitution Reverses Maternal Diet-Induced Social and Synaptic Deficits in Offspring. *Cell* 2016; **165**: 1762-1775 [PMID: 27315483 DOI: 10.1016/j.cell.2016.06.001]
8 **Kim S**, Kim H, Yim YS, Ha S, Atarashi K, Tan TG, Longman RS, Honda K, Littman DR, Choi GB, Huh JR. Maternal gut bacteria promote neurodevelopmental abnormalities in mouse offspring. *Nature* 2017; **549**: 528-532 [PMID: 28902840 DOI: 10.1038/nature23910]
9 **Escherich T**. The intestinal bacteria of the neonate and breast-fed infant. 1885. *Rev Infect Dis* 1989; **11**: 352-356 [PMID: 2649968 DOI: 10.1093/clinids/11.2.352]
10 **Nyangahu DD**, Jaspan HB. Influence of maternal microbiota during pregnancy on infant immunity. *Clin Exp Immunol* 2019; **198**: 47-56 [PMID: 31121057 DOI: 10.1111/cei.13331]
11 **Bäckhed F**, Roswall J, Peng Y, Feng Q, Jia H, Kovatcheva-Datchary P, Li Y, Xia Y, Xie H, Zhong H, Khan MT, Zhang J, Li J, Xiao L, Al-Aama J, Zhang D, Lee YS, Kotowska D, Colding C, Tremaroli V, Yin Y, Bergman S, Xu X, Madsen L, Kristiansen K, Dahlgren J, Wang J. Dynamics and Stabilization of the Human Gut Microbiome during the First Year of Life. *Cell Host Microbe* 2015; **17**: 690-703 [PMID: 25974306 DOI: 10.1016/j.chom.2015.04.004]
12 **Pugh JN**, Lydon KM, O'Donovan CM, O'Sullivan O, Madigan SM. More than a gut feeling: What is the role of the gastrointestinal tract in female athlete health? *Eur J Sport Sci* 2022; **22**: 755-764 [PMID: 33944684 DOI: 10.1080/17461391.2021.1921853]
13 **Dominianni C**, Sinha R, Goedert JJ, Pei Z, Yang L, Hayes RB, Ahn J. Sex, body mass index, and dietary fiber intake influence the human gut microbiome. *PLoS One* 2015; **10**: e0124599 [PMID: 25874569 DOI: 10.1371/journal.pone.0124599]
14 **Kautzky-Willer A**, Harreiter J, Pacini G. Sex and Gender Differences in Risk, Pathophysiology and Complications of Type 2 Diabetes Mellitus. *Endocr Rev* 2016; **37**: 278-316 [PMID: 27159875 DOI: 10.1210/er.2015-1137]
15 **Friedson-Ridenour S**, Dutcher TV, Calderon C, Brown LD, Olsen CW. Gender Analysis for One Health: Theoretical Perspectives and Recommendations for Practice. *Ecohealth* 2019; **16**: 306-316 [PMID: 31016438 DOI: 10.1007/s10393-019-01410-w]
16 **Yurkovetskiy L**, Burrows M, Khan AA, Graham L, Volchkov P, Becker L, Antonopoulos D, Umesaki Y, Chervonsky AV. Gender bias in autoimmunity is influenced by microbiota. *Immunity* 2013; **39**: 400-412 [PMID: 23973225 DOI: 10.1016/j.immuni.2013.08.013]

17 **Org E**, Mehrabian M, Parks BW, Shipkova P, Liu X, Drake TA, Lusis AJ. Sex differences and hormonal effects on gut microbiota composition in mice. *Gut Microbes* 2016; **7**: 313-322 [PMID: 27355107 DOI: 10.1080/19490976.2016.1203502]

18 **Mueller S**, Saunier K, Hanisch C, Norin E, Alm L, Midtvedt T, Cresci A, Silvi S, Orpianesi C, Verdenelli MC, Clavel T, Koebnick C, Zunft HJ, Doré J, Blaut M. Differences in fecal microbiota in different European study populations in relation to age, gender, and country: a cross-sectional study. *Appl Environ Microbiol* 2006; **72**: 1027-1033 [PMID: 16461645 DOI: 10.1128/AEM.72.2.1027-1033.2006]

19 **Stapleton S**, Welch G, DiBerardo L, Freeman LR. Sex differences in a mouse model of diet-induced obesity: the role of the gut microbiome. *Biol Sex Differ* 2024; **15**: 5 [PMID: 38200579 DOI: 10.1186/s13293-023-00580-1]

20 **Lay C**, Rigottier-Gois L, Holmstrøm K, Rajilic M, Vaughan EE, de Vos WM, Collins MD, Thiel R, Namsolleck P, Blaut M, Doré J. Colonic microbiota signatures across five northern European countries. *Appl Environ Microbiol* 2005; **71**: 4153-4155 [PMID: 16000838 DOI: 10.1128/AEM.71.7.4153-4155.2005]

21 **LE TM**, Nguyen HDT, Lee OE, Lee D, Choi Y, Chong GO, Cho J, Park NJ, Han HS, Seo I. Heterogeneity of gut microbiome compositions in the third decade of life in Japanese women: insights from a comparative analysis. *Biosci Microbiota Food Health* 2024; **43**: 73-80 [PMID: 38188664 DOI: 10.12938/bmfh.2023-043]

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