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Clinical Research and Clinical Reports

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Mini Review Article

Importance of Changes in the Gut Microbiota Milieu During Pregnancy and Beyond

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Received Date: 04 February 2025 **Accepted Date**: 12 February 2025 **Published Date**: 26 February 2025.

Citation: P D Gupta, (2025), Importance of Changes in the Gut Microbiota Milieu During Pregnancy and Beyond, Clinical research and Clinical reports 7(2): DOI: 10.31579/2835-8325/148

Abstract

There is an impact of change in maternal gut microbiota during pregnancy on fetal development, especially on gut–brain axis development, and also due to breast feeding, which transfer bacteria from mother to the baby have impact on development of immune system. This cycle of excess production of sex steroid hormones which in turn changes the microbiota composition during pregnancy and beyond takes care of life-long health outcomes of the baby.

Key words: sex steroid hormones; placenta; breast milk; immune system

Introduction

The crosstalk between sex hormones and the gut microbiota in various phases of woman's life is a hot topic in recent years. Pregnancy is a special physiological state of a woman. During this phase her morphology, physiology endocrinology, nutrition, Immunology and many other systems change in a way to support the developing embryo [1]. The composition of microbiota is regulated by the hormonal environment. Along with these changes gut -skin- brain axis of microbiota also changes to provide the foetus optimal conditions for growth and development. The development of the human gut microbiota begins before birth and proceeds in a systematic manner [2]. with the gut microbiome playing a particularly crucial role in this process by influencing the immune system, neurotransmitter production, and overall fetal health through complex communication pathways with the developing brain. The human microbiota consists of approximately 100 trillion organisms that mostly inhabit the digestive tract. The most important types of bacteria inhabiting the gastrointestinal tract include Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria.

Hormones impact the gut microbiota

Pregnancy is associated with significant hormonal shifts, leading to alterations in the gut microbiome that may play a role in pregnancy-related digestive issues. During pregnancy, a number of metabolic, immune, and hormonal changes have an influence on the development of the foetus as well on gut microbiota [2]. Beyond their traditional roles, sex hormones exert profound effects on various physiological systems including the gut microbiota. Fluctuations in sex hormone levels, notably during the pregnancy, influence gut physiology and barrier function, shaping gut microbiota composition and immune responses. Excess of estrogen and progesterone produced by the placenta influence the mechanisms of regulation of the cerebral and intestinal axis and the immune activation of the intestinal mucosa [3]. Hormonal changes, particularly fluctuations in sex hormones like estrogen and progesterone, significantly affect the composition and diversity of the gut microbiota, meaning that variations in hormone levels can directly influence the types and quantities of bacteria present in the gut; this is especially noticeable during menstrual cycles, pregnancy, menopause, and other periods of hormonal fluctuation.

Modifications in the composition of the microbiome occur between the first and third trimesters of pregnancy. There is an increase in Akkermansia, Bifidobacterium, and Firmicutes, which has been associated with an increase in the need for energy storage, and an increase in Proteobacteria and Actinobacteria, which, due to their pro-inflammatory qualities have a protective effect on both the mother and the foetus. The maternal microbiota affects the growth of the offspring in the prenatal and postnatal period and is important in their later life [4,5]. Beyond their traditional roles, sex hormones exert profound effects on various physiological systems including the gut microbiota. Fluctuations in sex hormone levels, notably during the menstrual cycle, influence gut physiology and barrier function, shaping gut microbiota composition and immune responses.

Composition of the microbiota

The composition of the microbiota is influenced by many factors, including the mother's health, the mode of delivery, and the feeding practices. Studies have shown that breast tissue has a distinct microbiota that is different from the microbiota of breast skin tissue, breast skin swabs, and buccal swabs. [6,7]. The breastmilk microbiota also evolves over the period of breastfeeding. Colostrum microbiota has a higher diversity than mature milk. it contains a wider variety of bacterial species; this is considered important for establishing a healthy gut microbiome in newborns. In colostrum, Staphylococcus, lactic acid bacteria and Streptococcus are the most abundant. However, depending on the source of bacteria, multiple factors could contribute to shaping the milk microbiota [8,9]

Breastfeeding shapes the gut microbiota in early life of the baby, both directly by exposure of the neonate to the milk microbiota and indirectly, via maternal milk factors that affect bacterial growth and metabolism such as human milk [10].

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