

Article

Impact of Vitamin D Deficit on the Rat Gut Microbiome

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Abstract: Inadequate immunologic, metabolic and cardiovascular homeostasis has been related to either an alteration of the gut microbiota or to vitamin D deficiency. We analyzed whether vitamin D deficiency alters rat gut microbiota. Male Wistar rats were fed a standard or a vitamin D-free diet for seven weeks. The microbiome composition was determined in fecal samples by 16S rRNA gene sequencing. The vitamin D-free diet produced mild changes on α -diversity but no effect on β -diversity in the global microbiome. Markers of gut dysbiosis like *Firmicutes*-to-*Bacteroidetes* ratio or the short chain fatty acid producing bacterial genera were not significantly affected by vitamin D deficiency. Notably, there was an increase in the relative abundance of the *Enterobacteriaceae*, with significant rises in its associated genera *Escherichia*, *Candidatus blochmannia* and *Enterobacter* in vitamin D deficient rats. *Prevotella* and *Actinomyces* were also increased and *Odoribacteraceae* and its genus *Butyrivimonas* were decreased in rats with vitamin D-free diet. In conclusion, vitamin D deficit does not induce gut dysbiosis but produces some specific changes in bacterial taxa, which may play a pathophysiological role in the immunologic dysregulation associated with this hypovitaminosis.

Keywords: microbiota; 16S rRNA sequencing; vitamin D deficit

1. Introduction

The gut microbiota is an ecological community constituted by a large number of bacteria, archaea, protists, fungi and viruses. The microbiota produces multiple metabolites that may cross the intestinal barrier and exert biological effects [1]. The microbiota also impacts on the integrity of the gut barrier. Gut barrier dysfunction may result in bacterial translocation from the intestines with increased plasma lipopolysaccharides (LPS) [2]. Multiple studies have found a relationship between the microbiota and adequate metabolic, hormonal and immunologic homeostasis [3–5]. Gut dysbiosis, i.e., an altered composition of the intestinal microbiota in disease is associated with poor health outcomes. Dysbiosis may be treated with probiotics, i.e., live strains of selected bacteria, or prebiotics, food components that modulate the microbiota [6,7]. Multiple metabolic, cardiovascular, and respiratory diseases including type 2 diabetes mellitus, obesity, systemic and pulmonary hypertension, atherosclerosis, heart failure and chronic respiratory diseases have been linked to impaired gut microbiota [8–13]. Dysbiosis is