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Short Communication

Type 2 Diabetes Mellitus and Strongyloides Stercoralis Infection

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Abstract

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disease that causes severe complications in those affected. Its prevalence is increasing considerably worldwide, especially in low- and middle-income countries due to urbanization and migration, many of which are located in tropical and subtropical regions where helminths, such as Strongyloides stercoralis, are highly endemic. These helminths are believed to be involved in the immunomodulation of T2DM and even in its complications. The objective of this paper is to present concise information on this topic, based on an analysis of the existing scientific literature on the subject.

Kew Words: diabetes mellitus; Strongyloides stercoralis; infection; helminths; metabolic disorder

Introduction

Type 2 diabetes mellitus (T2DM) is a major public health problem (an estimated 537 million adults worldwide between 20 and 79 years of age suffer from this disease, representing 10.5% of the population in this age group) because its incidence is increasing in low- and middle-income countries (due to increased urbanization and migration) and because of the severe macrovascular (peripheral and coronary vascular disease), microvascular (renal and retinal disease), and neuropathic complications it produces in affected individuals. T2DM is a metabolic disorder characterized by persistent hyperglycemia, chronic low-grade systemic inflammation with a predominance of Th1 cells, and intestinal microbial dysbiosis. Furthermore, comorbidity between T2DM and pathogens such as parasites is frequent, particularly where these are endemic [1-7].

In this regard, it has been noted that some parasites, particularly helminths (Schistosoma spp., geohelminths [including Ascaris lumbricoides, Trichuris trichiura, Ancylostoma duadenale], and filarial nematodes), improve insulin sensitivity and metabolic function against the development of type 2 diabetes based on their ability to regulate the gut microbiota and innate and adaptive immune responses (in order to ensure their survival in the host). Consequently, these parasites are believed to protect against T2DM in an inversely proportional relationship [8-16].

Among the geohelminths involved in the immunoregulation of T2DM, Strongyloides stercoralis deserves special mention due to its prevalence exceeding 600,000,000 infected individuals (primarily in tropical and subtropical regions), its status as a neglected tropical disease, its complex life cycle (free-living and autoinfection), its capacity to parasitize the host for decades, the fact that its chronic form is usually asymptomatic, and because its severe forms (hyperinfection syndrome and disseminated strongyloidiasis), mainly in immunocompromised individuals, are fatal in 70% of cases [4, 17-19]. The objective of this literature review is to demonstrate the association between S. stercoralis infection and T2DM.

Association between T2DM and S. stercoralis infection

There is an inversely proportional association between S. stercoralis infection and T2DM, according to several research reports, involving nutrition, intestinal homeostasis (modification of intestinal microbial diversity), and the immunoregulatory response. Regarding the latter, the parasites alter the Th1/Th2 immune polarization, with the consequent reduction in the systemic concentration of proinflammatory cytokines (IL-4 over IL-17, TNF-α, and IFN-γ) and the shift in the macrophage pattern to M2, modulating inflammation [4, 9, 20].

One of the mechanisms underlying the development of T2DM is chronic inflammation characterized by the production of pro-inflammatory cytokines and chemokines, leading to increased insulin resistance. However, helminth infections are characterized by the induction of a type 2 immune response, leading to the production of regulatory cytokines, which can modulate inflammation [4, 12, 22].

The protective association of S. stercoralis in T2DM appears to extend beyond this, limiting the development of complications in various organs, particularly vascular complications. However, the physiological mechanism involved and the role of S. stercoralis in the development of

multimorbidity complications, especially kidney disease, remain unknown. This is due to numerous unknown variables, such as the duration of infection, parasite load, age of participants, geographic distribution, and even cultural and dietary habits [4, 21-23].

S. stercoralis, however, is considered a risk factor for morbidity in humans, primarily kidney disease, possibly related to the increased deposition of immune complexes of this parasite's antigens in the kidneys and also to the production of uremic toxins that end up in the kidney due to the alteration of intestinal microbial diversity experienced by the host with the parasitic infection. In any case, further studies on both pathophysiological processes are required [4, 24, 25].

Conclusion

The geohelminth S. stercoralis protects against T2DM by modulating the host's immune system, specifically by modifying the Th1/Th2 polarization. This alters the secretion of specific types of systemic cytokines, chemokines, and adipokines, as well as the biochemical parameters that counteract insulin resistance. Furthermore, the parasite has a beneficial effect on the diabetic host, reducing the occurrence of complications, especially vascular ones, although the mechanism involved is largely uncertain. However, the parasitic infection poses a risk of kidney disease due to the deposition of antigen-containing immune complexes in the kidney.

Conflict of interests

The authors have no conflict of interest to declare. The authors declared that this study has received no financial support.

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