

Adverse effects of synergic factors at play during intestinal parasitism in pregnancy

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Abstract

Intestinal parasitism is a widely extended public health problem, causing significant morbidity and disabilities. It is well documented that pregnancy, with its increased nutritional demands and altered immune defenses, is an especially vulnerable time to contract intestinal parasitism. By affecting the health of both mothers and their progeny, those parasite infections are a double burden for pregnant women, who often experience more severe intestinal parasitism than their non-pregnant counterpart. It should be taken into account that in this health problem concur synergistically factors related to parasites, the physiological peculiarities of the pregnant women and the socioeconomic scenario in which they live. Despite the adverse effects of intestinal parasitism on pregnancy, fetuses, and newborns, its worldwide prevalence, and the associated risk factors, among pregnant women are little known. In spite of this, with the information available today, it is possible to sustain that the prevalence of intestinal parasitism among pregnant women is greater in by low and middle income countries. As we argue in the text of this document, intestinal parasite infections constitute an underestimated public health problem among pregnant women and their offspring and, accordingly, we opine that their diagnosis, treatment, and control require more attention.

Keywords: Intestinal parasitism; Pregnant women; New born; Pregnancy immunomodulation; Helminth immunomodulation.

Introduction

Parasites infect pregnant women with relatively high frequency [1-3]. It is a consequence of two interacting physiological processes that occurs in the woman during pregnancy: the natural modulation of her immune responses and the occurrence of changes in her microbiota, both necessary for the healthy development of the fetus [1,4]. Intestinal parasitism (IP) is a widely extended public health problem, resulting in significant morbidity and disabilities. With the increasing of travel and food transport around the world, that problem is not entirely confined to traditionally endemic areas [5]. It is well documented that pregnancy, with its increased nutritional demands and altered immune defenses, is an especially vulnerable time to contract parasitic infections. In addition, several of them can occur simultaneously, increas-

ing the adverse consequences for mothers and progeny [6-7]. Despite the deleterious effects of IP on pregnancy, fetuses, and newborns, little is known about its worldwide prevalence among pregnant women, and its associated risk factors. Nevertheless, with the information available today, it is possible to sustain that IP prevalence among pregnant women is greater by low and middle income countries (LMIC) [8-9]. The effects and severity of IP on pregnancy depend on different factors in relation with the mother and its scenario, including species involved, parasitic load, coexisting infections, intervals between pregnancies, nutritional health, immunity status, accessibility of safe drinking water, climate, and socioeconomic condition. Although IP can occur at any stage of the three trimesters of pregnancy, infection during the first trimester is associated with more serious fetal and placental consequences than those that occur later. It should be mentioned that wom-

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en who are pregnant for the first time experience more severe consequences of IP compared to other gravid women [10-11]. Over the past few years, our understanding of how to prevent and manage IP in pregnant women has increased. In spite of it, IP remain a sanitary challenge. At least two factors have prevented more progression: (i) the low sustainability of the executed prevention and control actions, and (ii) the fact that therapeutic interventions during pregnancy can lead to unexpected complications for the health of the mother and child. As it will be shown in the following texts of this document, intestinal parasitic infections constitute an underestimated public health problem among pregnant women and, consequently, their diagnosis, treatment, and control require more attention.

Prevalence on intestinal parasitism in pregnant women

As we mentioned above, the IP prevalence among pregnant women, and its associated risk factors, is relatively little known. Pregnancy affects the mother's body physical, physiological, and immunologically. It is a unique stage with different hormonal and immunological alterations. The change in immunity that occurs in pregnant women makes them susceptible to most parasitic infections [12-13]. Recent evidence suggests that the microbial alterations during pregnancy may help maintain homeostasis and aid the physiological changes that occur in pregnancy. However, these same immunological and microbial alterations can also make women more susceptible during pregnancy and the postpartum period, especially with regard to immunological and infectious diseases [14-15]. On the other hand, pregnant women are at high risk of intestinal parasite infections due to their close relationship with children, the segment of population with the higher prevalence of IP [16]. Additionally, most of those parasites are transmitted through the soil, and the practice of eating it is common among pregnant women in many communities, especially in sub-Saharan Africa [17-18]. Numerous studies on the prevalence of IP in pregnant women have been carried out in recent years, mainly in countries of Africa, Asia and Latin America [revised in 3]. However, the methodological differences in the performance of those studies (for example, in the number of fecal samples collected per participating individual and in the types of detection procedures employed in each work) have made difficult to interpret and compare their results accurately. Roughly speaking, the analysis of the available information has permitted the identification of the parasites most frequently found during pregnancy: among helminths *Schistosoma mansoni*, *Ascaris lumbricoides*, *Trichuris trichiura* and hookworms; and among protozoa, *Plasmodium* spp., *Entamoeba histolytica* and *Blastocystis* spp. [1-3]. The prevalence of IP among pregnant women in more endemic countries, generally those with tropical climate and low socioeconomic development, ranges from 24 to 70%, with approximately 10% of women having multiple parasites [5]. In Africa, more than 44 million pregnancies are complicated by maternal infection with hookworm, and 10 mil-

lion pregnant women are infected with schistosomes [19].

General impacts of intestinal parasitism on pregnant women

IP during pregnancy is associated with serious adverse maternal and fetal outcomes [20]. Intestinal parasites have a broad number of interrelated consequences for pregnant women and their offspring, including maternal anemia [1,21], low weight gain during pregnancy, poor fetal growth [22-23], low birth weight [23], and premature delivery [24]. The risk of infertility and spontaneous abortions are also caused by those infections [25-26]. Pregnant women and intestinal parasites- both helminths and protozoa- compete by critical molecules and energy sources such as iron, glucose, lipids, proteins, and other essential nutrients. This competition can have devastating effects on fetal growth and development [27]. Many helminths reduce appetite and compromise nutrient intake which, accompanied by helminth-induced intestinal inflammation, can limit nutrient absorption and lead to anemia [28]. In addition, hookworms, schistosomes, and *T. trichiura* can cause anemia by intestinal blood loss too [3]. In relation with pregnancy, hookworms should be mentioned apart. Worldwide, the prevalence of hookworms in pregnant women is high. The effects of those parasites on pregnant women and their fetus vary widely from asymptomatic to infection resulting in malnutrition, anemia, intrauterine growth retardation, and spontaneous abortion [29]. Each year, they result in 3,000 to 65,000 maternal deaths [3]. The benefits of anthelmintic treatment during pregnancy are still not entirely clear, both for the mother and the offspring. Even if there is current global control efforts based on regular mass administration of anthelmintic drugs, its sustainability appears very difficult [30-31]. Helminths modulate the immune response of their hosts in order to survive in them [32-35]. In pregnant women, helminth infections may have increased adverse effects due to the synergistic immunoregulatory effects of pregnancy and those parasites. Therefore, pregnant women with helminth infections are at greater risk of contracting infectious diseases such as malaria, measles and influenza [36]. It should be noted that most of the studies referencing the synergistic immunoregulatory effects of pregnancy and helminth infections come from LMIC with poor nutritional status. Without proper nutrition, the immune system does not mount an effective response to infection. At the same time, helminth infections are a cause of malnutrition and deterioration of the immune system. In this complex scenario, pregnant women with helminth infections may be more susceptible to other pathogens due to the synergistic effects on immune system of malnutrition, pregnancy, and helminth infections. [36-37]. As many helminths survive in the environment and have animal reservoirs, a holistic approach to their control, as invite the viewpoints of One Health, is mandatory. Intestinal protozoa can promote loss of indigenous nutrients by inducing damage to the intestinal mucosa, hindering digestion

and causing diarrhea and anemia [3]. *Giardia lamblia* infection causes restriction of iron absorption [3]. *E. histolytica* invasion on intestinal mucosa leads to blood loss [38]. The prevalence of blastocystosis, an entity rarely reported at the end of the last century, has increased rapidly in recent years [39-40]. Recently, the high prevalence of *Blastocystis* spp. infection in pregnant women and its association with iron deficiency anemia have been evidenced [41-42]. Unfortunately, the mechanisms supporting this association remain poorly understood. On the other hand, and opining from a more holistic perspective, all analysis of the anemia caused by IP should take into account that pregnant women are particularly susceptible to the development of anemia due to their exponential rise of iron requirements, necessary to support the expanding of the maternal erythrocyte component and the growth of the fetal-placental unit [43-44]. Nearly 40% of pregnant women worldwide have anemia, which is more common in low-income nations [45]. In the mother, anemia is associated with an increment of infection and hospitalization, preterm delivery, poor labor and severe hemorrhagic phenomena; in the fetus, anemia may result in growth retardation and low birth weight, among others adverse outcomes [44-48].

Conclusions

In spite of methodological and resource limitations in the performance of the corresponding studies, it has been evidenced the high prevalence of IP in pregnant women in underdeveloped countries of Africa, Asia and Latin America. In those countries, intestinal parasite infections constitute an underestimated public health problem that affects pregnant women and their progeny, and accordingly, their diagnosis, treatment, and control require more attention. In this sense, it should be taken into account that in this health problem concur synergistically factors related to parasites, the physiological peculiarities of the pregnant women and the socio-economic scenario in which they live. Looking at the problem from a more inclusive perspective, the current initiatives to improve the IP prevention and control of IP in populations at risk in those endemic areas should include actions in their communication strategies to inform, from One Health approaches, about the adverse consequences of intestinal parasitism on the wellbeing of mothers and their progeny.

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