Received: 6 August 2021 | Accepted: 18 August 2021

DOI: 10.1111/andr.13100

ANDROLOGY WILEY

LETTER TO THE EDITOR

A suggestion to overcome potential risks for infertility due to COVID-19: A response to Aitken

We are writing this letter as scientists that contributed to leading peer reviewed journals regarding female and male fertility. In particular, our group investigated the possible effects of a natural carotenoid (Astaxanthin) on human spermatozoa.[1–3] We have carefully read the article by Robert John Aitken regarding the role of SARS-CoV-2 on spermatozoa.[4] The author points out that mature spermatozoa manage to bind the virus and also achieve reverse transcription. By doing this, spermatozoa could act as vectors for the disease. In fact, spermatozoa express ACE1 and ACE2 and the infection generates an increase of angiotensine-II. The ACE 2 is important in sperm biology because it prevents spermatozoa from engaging the apoptotic pathway. The exposure to COVID 19 causes the cleavage of ACE2 inducing a decrease in sperm viability and function. Aitken also states that COVID attack increases angiotensin availability and this increases sperm fagocitosis by neutrophil and the local levels of reactive oxygen species (ROS). As evidenced in one of our studies[5] and Aitken's study,[4] ROS production is required for sperm capacitation, however high levels of inflammation have a negative effect upon sperm[4] and SARS-CoV-2 may impact on sperm quality also through this mechanism. A febrile episode can have adverse effects on conventional semen parameters (sperm volume, sperm count, vitality, motility, and morphology) as well as on sperm DNA integrity, but these are temporary and reversible. These effects may be brought about by two factors, hyperthermia and heat stress. There is evidence that hyperthermia can adversely affect sperm membrane integrity and fertilization capacity. In addition, oxidative stress, as a consequence of high temperature, may play a role in the suppression of spermatogenesis. We have previously demonstrated the role of Astaxanthin (Asta) on human semen.[1–3] Asta is a photo-protective red pigment belonging to the carotenoid family that shares a similar beta-carotene structure. It is synthesized by the microalgae *Haematococcus pluvialis* in the presence of stressful conditions including, nitrogen deficiency, high salinity, and high temperature. Asta is known for its antioxidant and anti-inflammatory properties, and more specifically it inhibits cyclooxygenase 2 enzyme activities. It is present in many dietary supplements and is also used for sperm quality improvement treatment. We previously demonstrated that Asta has positive effects on some semen parameters and male fertility by increasing sperm concentration and linear velocity, thus ameliorating fertilizing power.[1,3] Moreover, sperm undergoes a series of transformations during the process of capacitation, including ROS production and membrane rafts translocation, which are necessary for acrosome reaction. In particular, Asta is shown to ameliorate the Tyr-phosphorylation Tyr-P pattern of the head and acrosome reaction independently of the redox process of cells. It is possible to insert Asta into the membrane leading lipid rafts relocation and create a capacitation-like membrane alteration. Therefore, a subsequent acrosome reaction can take place.[3]

Aitken reports that a recent analysis revealed that among 38 semen samples from COVID 19 patients six were tested positive for the virus by RT-PCR[4] and also with the presence of the virus in the seminal fluid Asta might play a role. In fact, it has been demonstrated that Asta can prevent the human papillomavirus L1 protein binding in human sperm membranes, reducing the presence of L1 by more than 50%.[2]

To conclude, as evaluated by Aitken, patients with SARS-CoV-2 infection may have altered semen, as the infection could potentially affect spermatogenesis through inflammation with an exaggerated production of ROS, while Asta supplementation could lead to reduced inflammation, keeping the essential levels of ROS required for sperm capacitation.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

FUNDING INFORMATION

This study had no funding and no financial support.

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