proceedings

MDPI

Abstract

Modulation of Antioxidant Pathway by Bioactive Peptides: Impact on Post-Thaw Sperm Viability and Motility †

Bruno S. Sá [1,2], Ana Gabriela P. Meneses [1], Sophia A. dos Reis [3], Natália P. B. Valadares [1,4], João B. Nunes [5], Pedro Paulo R. C. Melo [1], Andreanne G. Vasconcelos [1,2] and José Roberto S. A. Leite [1,2,*]

[1] Applied Immunology and Morphology Research Centre (NuPMIA), Morphology Area, Faculty of Medicine, University of Brasília (UnB), Brasília 70910-900, Brazil; brunosilvasa13@outlook.com (B.S.S.); ana.gabriela.portela.meneses@gmail.com (A.G.P.M.); dranatalia.genesis@gmail.com (N.P.B.V.); pedropaulorocha1702@gmail.com (P.P.R.C.M.); andreannegv@gmail.com (A.G.V.)
[2] People&Science Pesquisa Desenvolvimento Inovação Ltda., Centro de Apoio ao Desenvolvimento Tecnológico (CDT), University of Brasília (UnB), Brasília 70910-000, Brazil
[3] Unified Education Center of the Federal District (UDF), Brasília 70390-045, Brazil; sophhiareis@gmail.com
[4] Genesis—Human Reproduction Assistance Center, Brasília 70390-700, Brazil
[5] Laboratory for the Synthesis and Analysis of Biomolecules, Institute of Chemistry, University of Brasília (UnB), Brasília 70910-900, Brazil; joaobueno70@gmail.com
* Correspondence: jrsaleite@gmail.com
† Presented at the 6th International Congress on Health Innovation—INOVATEC 2025, Hybrid, 21–23 November 2025.

Keywords: sperm motility; antioxidants; freezing

Introduction: Sperm cryopreservation is a crucial advancement for fertility preservation—whether for social or clinical medical reasons—allowing for the postponement of gamete use and favoring reproductive planning. However, structural and functional damage, such as reduced motility and cell viability, are observed post-thaw due to redox imbalance. This imbalance is generated by the overproduction of free radicals from mitochondrial metabolism and/or the suppression of endogenous antioxidants during the freezing process. To mitigate this redox imbalance, we investigated the supplementation of the cryoprotective medium with the antioxidant peptides Antioxidin-I and PaT-2 during the freeze–thaw procedure. Thus, the objective of this study was to evaluate the cytotoxicity and progressive motility of human spermatozoa after seminal thawing. **Methodology**: For the analysis of cytotoxicity (Luciferase assay) and progressive motility (Makler chamber), spermatozoa (2×10^6 per cryotube) were evaluated, processed, and frozen in liquid nitrogen for 21 days in DMEM culture medium supplemented with Antioxidin-I and PaT-2 (12.5–200µM). **Results**: Regarding cytotoxicity, both peptides demonstrated biocompatibility by not significantly reducing gamete viability. In terms of progressive motility (%), the frozen group supplemented with Antioxidin-I (100 µM—42 ± 7% and 200 µM—71 ± 5%) significantly preserved progressive motility compared to the fresh control group (83 ± 2%). PaT-2, however, did not show satisfactory results at any of the tested concentrations. **Conclusions**: Antioxidin-I demonstrated biocompatibility and dose-dependent efficacy in preserving sperm motility. This suggests its capacity to neutralize free radicals and its potential for use in the cryogenic process to maintain seminal parameters post-thaw.

Author Contributions: Conceptualization, B.S.S., A.G.V. and J.R.S.A.L.; investigation, B.S.S., A.G.P.M., S.A.d.R., N.P.B.V., J.B.N., P.P.R.C.M. and A.G.V.; writing—original draft preparation, B.S.S.; writing—review and editing, B.S.S., A.G.V. and J.R.S.A.L.; supervision, J.R.S.A.L. All authors have read and agreed to the published version of the manuscript.

Check for updates

Academic Editors: Andreanne Vasconcelos, Amílcar Damazo and José Roberto Leite

Published: 4 March 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Faculty of Medicine, University of Brasília (protocol code 6.584.381 and date of approval 17 December 2023).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to ethical aspects.

Conflicts of Interest: Author A.G.V. and J.R.S.A.L. are partner at company People&Science; Author B.S.S. was employed by the company People&Science; Author N.P.B.V. was employed by the company Genesis. The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.