LETTER TO EDITOR

Potential Role of Physical Activity in Hantavirus Prevention and Recovery

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Dear Editor,

Hantavirus infection remains a serious zoonotic illness that causes serious problems in the human heart, lungs, and kidneys. The virus is usually spread through the inhalation of aerosolized particles contaminated with rodent urine, saliva, or feces, and it has been identified as a public health threat in various countries across the world. Hantavirus infections have been reported across Asia, Europe, and the Americas, with thousands of cases of hemorrhagic fever with renal syndrome (HFRS) occurring annually worldwide. In the Americas, hantavirus cardiopulmonary syndrome (HCPS) remains a rare but highly fatal disease, with reported case-fatality rates often exceeding 30%. Despite extensive research on the epidemiology, transmission, and clinical manifestations of hantavirus infection, the potential role of physical activity in prevention and recovery remains underexplored.[1]

Regular physical activity is widely recognized as an important modulator of immune function. Exercise at a moderate level has been demonstrated to promote immune cell circulation, strengthen immunological surveillance, and lessen persistent systemic inflammation. Previous studies suggest that physically active individuals may be less susceptible to infectious diseases and may experience improved outcomes following viral infections, according to earlier research. Additionally, exercise improves pulmonary and cardiovascular health, which may be especially important in cases of HCPS, where respiratory compromise is a significant clinical problem.[2]

Exercise and viral infections have a complicated relationship that seems to rely on the level and duration of physical activity. While continuous high-intensity exercise may temporarily decrease immune responses and increase susceptibility to infection, moderate exercise is typically linked to positive immunological effects. As a result, suggestions for physical activity in populations that are susceptible to hantavirus exposure should be carefully considered and backed by empirical data. Hiking, camping, farming, and wilderness sports are examples of outdoor recreational activities where people may come into surroundings contaminated by diseased rodents, which could raise the risk of exposure. Also, any recommendation regarding physical activity in populations at risk of hantavirus exposure should be accompanied by strict adherence to environmental hygiene measures, rodent-control strategies, and public health guidance aimed at minimizing contact with contaminated environments. Physical activity should not be interpreted as a substitute for established preventive measures against hantavirus infection. Therefore, for physically active groups, public health education that emphasizes environmental hygiene, preventative measures, and awareness of hantavirus transmission is still crucial. While these preventive measures remain essential for reducing exposure risk, the potential therapeutic role of exercise after infection warrants equal attention.[3,4]

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Another important consideration is the potential role of exercise during recovery from hantavirus infection. After being admitted to the hospital, survivors of HFRS and HCPS may have extended exhaustion, decreased exercise tolerance, weakened muscles, and compromised cardiopulmonary capacity. Gradual physical activity therapies and structured rehabilitation programs may increase functional recovery, improve quality of life, and lessen long-term disability. Carefully regulated exercise regimens may improve recovery results, according to evidence from rehabilitation studies in other severe viral infections. However, direct evidence regarding rehabilitation strategies for hantavirus survivors remains limited.[5]

Furthermore, additional research is needed to clarify the relationship between hantavirus pathogenesis and exercise-induced immune modulation. Exaggerated inflammatory responses and cytokine dysregulation are believed to be significant factors in the severity of hantavirus infection. Also, exercise-induced immune adaptations may influence several inflammatory mediators implicated in hantavirus pathogenesis. Severe HCPS is characterized by endothelial dysfunction, excessive cytokine release, and alterations in inflammatory markers, including interleukin-6 (IL-6), tumor necrosis factor-α (TNF-α), and plasminogen activator inhibitor-1 (PAI-1).[5] Moderate physical activity has been shown to modulate these inflammatory pathways and may contribute to improved immune homeostasis and vascular function. Future studies should investigate whether exercise-induced physiological adaptations affect susceptibility, disease course, or recovery trajectories in infected individuals, given the potential for moderate physical activity to influence inflammatory pathways and immunological homeostasis.[6]

There is currently insufficient data to make firm judgments regarding the therapeutic or protective benefits of physical activity for hantavirus infections. However, the importance of cardiac rehabilitation and the biological plausibility of exercise-mediated immunological benefits highlight the necessity of collaborative study including immunologists, public health researchers, sports medicine professionals, and infectious disease specialists. To better understand if physical activity can aid in hantavirus prevention and recovery, more clinical and community studies may be beneficial. In summary, physical activity may be an important but little-studied component of hantavirus-related health consequences. While excessive outdoor exposure in contaminated areas may simultaneously raise the risk of infection, moderate exercise may contribute to immune modulation and functional recovery. Further scientific investigation may help establish evidence-based preventive and rehabilitation strategies for populations affected by hantavirus infection.

Keywords Immunomodulation, Physical activity, Prevention and control, Rehabilitation, Hantavirus infections

Declarations

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Authors' Contributions
Amir Hossein Hormati Oughoulbaig conceived the study idea. Amir Hossein Hormati Oughoulbaig and Narges Yazdan Nasab conducted the literature review, drafted the manuscript, and participated in the preparation and revision of the manuscript. Asadollah Asadi supervised the study, provided scientific oversight, contributed to manuscript review and editing, and approved the final version of the manuscript. All authors read and approved the final manuscript.

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The authors declare no conflict of interest.

Consent for Publication
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