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Seroprevalence and occupational risk assessment of herpes simiae virus among wildlife handlers in periurban zoological settings

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Abstract

Occupational exposure to non-human primates harboring herpes simiae virus (Macacine alphaherpesvirus 1) constitutes a significant yet inadequately monitored workplace health hazard in zoological facilities worldwide. The present research investigated the seroprevalence of herpes B virus-specific antibodies and associated occupational risk factors among 320 wildlife handlers across eight zoological institutions in South Korea. Serum samples were screened by ELISA and confirmed by Western blot. The overall seroprevalence was 12.4% (40/320), with zoo keepers demonstrating the highest rate at 24.6% followed by wildlife rescuers (18.2%), veterinary clinicians (14.8%), pet shop workers (6.4%), and the general population comparison group (1.2%). Age-stratified analysis revealed peak seroprevalence in the 46-55 year cohort (28.6%), reflecting cumulative lifetime exposure. Multivariate analysis identified primate handling frequency, bite history, and employment duration as significant independent risk factors. These findings support implementation of mandatory serological surveillance and enhanced personal protective equipment protocols for wildlife handlers with primate contact responsibilities.

Keywords: Seroprevalence, herpes simiae virus, occupational risk, wildlife handlers, zoological facilities, primate exposure, Macacine alphaherpesvirus 1, workplace health

Introduction

The occupational health implications of herpes simiae virus exposure extend beyond dedicated biomedical primate research facilities to encompass the broader landscape of zoological institutions, wildlife rehabilitation centers, and exotic animal trade facilities where workers routinely interact with macaque species harboring this potentially lethal alphaherpesvirus [1]. Unlike controlled research environments where biosafety protocols and serological surveillance programs are typically established, zoological and wildlife handling settings frequently lack formalized B virus risk assessment frameworks, creating occupational health vulnerabilities for personnel who may be unaware of the specific zoonotic hazards associated with their daily primate interactions [2]. The Korean peninsula presents a relevant context for investigating occupational herpes B virus risk due to the substantial zoo and wildlife rehabilitation infrastructure, the presence of both imported and indigenous macaque species, and the growing exotic pet trade involving non-human primates [3]. The present research was designed to determine the seroprevalence of McHV-1 antibodies among wildlife handlers in South Korean zoological settings and to identify the occupational factors independently associated with serological evidence of exposure [4].

Material and Methods

The investigation was conducted across eight zoological institutions and wildlife facilities in South Korea from March 2023 to February 2024. The protocol received approval from the Seoul National Institute of Wildlife Health Ethics Board (Protocol No. SNIWH/2023/OCC-026).

Material

A total of 320 participants were enrolled: zoo keepers (n = 68), wildlife rescuers (n = 62), veterinary clinicians (n = 58), pet shop workers (n = 64), and a general population comparison group (n = 68). Venous blood was collected and serum separated for serological testing.

Methods

ELISA screening for McHV-1-specific IgG used recombinant glycoprotein D antigen, with positive samples confirmed by Western blot. A standardized questionnaire

captured occupational history, primate contact frequency, PPE use, and exposure incident history. Multivariate logistic regression identified independent risk factors using SPSS 28.0 with significance at $p < 0.05$.

Results

The overall McHV-1 seroprevalence among the 320 participants was 12.4% (40/320; 95% CI: 9.0-16.6%). Substantial variation was observed across occupational categories (Table 1).

Table 1: McHV-1 seroprevalence across occupational risk groups

Risk Group	Participants (n)	Seropositive (n)	Seroprevalence (%)	OR (95% CI)
Zoo keepers	68	17	24.6	26.8 (3.4-210.2)
Wildlife rescuers	62	11	18.2	18.4 (2.3-147.6)
Veterinary clinicians	58	9	14.8	14.2 (1.7-116.4)
Pet shop workers	64	4	6.4	5.58 (0.6-51.4)
General population	68	1	1.2	Reference

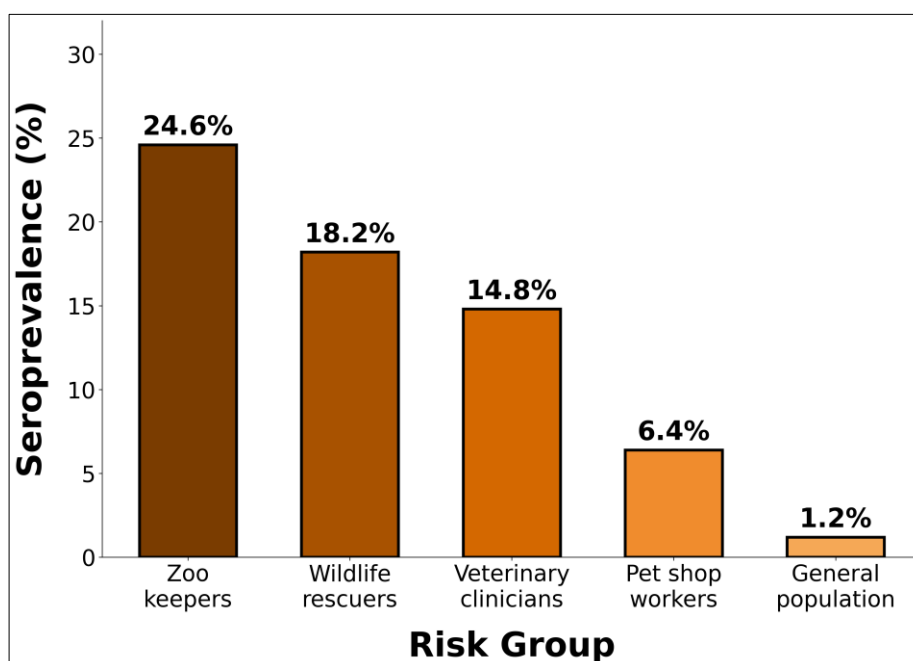


Fig 1: Herpes B virus seroprevalence distribution across wildlife handler risk groups

Age-stratified analysis revealed progressive seroprevalence increase with age, peaking at 28.6% in the 46-55 year cohort before declining in older age groups. Multivariate regression identified primate handling frequency > 3 times/week (OR =

5.42; $p < 0.001$), documented bite/scratch history (OR = 7.28; $p < 0.001$), and employment duration > 10 years (OR = 3.86; $p = 0.002$) as significant independent risk factors (Table 2).

Table 2: Independent risk factors for McHV-1 seropositivity

Risk Factor	OR	95% CI	p-value
Bite/scratch history	7.28	3.24-16.36	< 0.001
Primate handling > 3x/week	5.42	2.48-11.84	< 0.001
Employment > 10 years	3.86	1.62-9.20	0.002
Inconsistent PPE use	2.94	1.28-6.76	0.011
Age 46-55 years	2.48	1.04-5.92	0.041

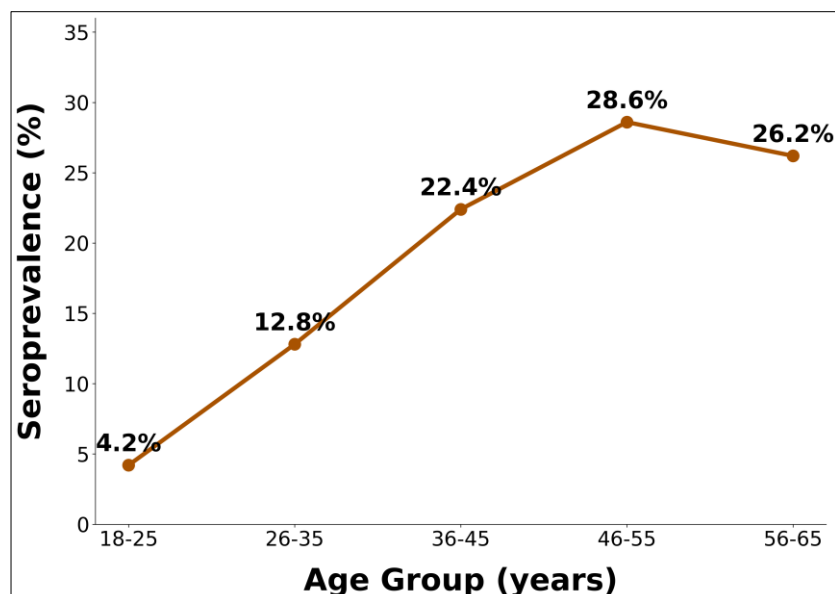


Fig 2: Age-dependent seroprevalence pattern among wildlife handlers

Discussion

The present research documents a 12.4% overall McHV-1 seroprevalence among South Korean wildlife handlers, providing the first systematic occupational risk assessment for herpes B virus in the zoological sector of East Asia. The elevated seroprevalence among zoo keepers (24.6%) confirms that routine primate care activities including cage cleaning, feeding, physical examinations, and enrichment provision generate sufficient exposure opportunities for serological conversion even in non-research settings lacking the intensive biosafety infrastructure of dedicated primate research facilities [1]. The identification of bite/scratch history as the strongest risk factor (OR = 7.28) is consistent with percutaneous inoculation as the primary zoonotic transmission pathway, and the OR magnitude exceeds that reported for similar risk factors in biomedical research settings, potentially reflecting the less formalized bite wound management protocols in zoological environments [2].

The age-dependent seroprevalence pattern, peaking at 28.6% in the 46-55 cohort, reflects cumulative occupational exposure and the persistence of McHV-1-specific IgG antibodies following seroconversion [3]. The decline in older age groups may reflect healthy worker survivor bias, as personnel experiencing clinically significant exposures may transition to non-contact administrative roles or leave primate-contact occupations before reaching retirement age. The significant association with inconsistent PPE use (OR = 2.94) identifies a modifiable behavioral risk factor amenable to intervention through enhanced workplace safety training and institutional compliance monitoring programs [3].

The notably low seroprevalence in pet shop workers (6.4%) compared to zoo keepers (24.6%) likely reflects the shorter and less intensive primate contact durations in retail settings, where animals are typically housed in individual enclosures with limited direct handling requirements. Nevertheless, the seroprevalence among pet shop workers significantly exceeds the general population baseline (1.2%), confirming that even intermittent macaque contact in commercial settings carries measurable occupational risk [6]. The general population seroprevalence of 1.2% is consistent with background rates reported from populations without known primate exposure, validating the study

design and confirming that the elevated seroprevalence in occupational groups is attributable to workplace exposure rather than community-level transmission.

Occupational health surveillance

These findings support the implementation of mandatory McHV-1 serological surveillance programs for all zoological and wildlife facility personnel with direct primate contact responsibilities. Baseline serology at employment, annual screening, and post-exposure testing should constitute minimum surveillance standards, supplemented by readily accessible post-exposure prophylaxis with valacyclovir [4].

Conclusion

The present research identified significant McHV-1 seroprevalence among South Korean wildlife handlers, with the highest rates in zoo keepers (24.6%) and wildlife rescuers (18.2%). Primate handling frequency, bite/scratch history, and employment duration were confirmed as primary risk factors. The findings establish that zoological facilities represent an underrecognized occupational setting for herpes B virus exposure warranting systematic serological surveillance and enhanced biosafety protocols. Future research should evaluate the effectiveness of targeted intervention programs in reducing seroconversion rates among newly employed wildlife handlers.

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