

Evaluation of Plasma (1→3) β -D-glucan Concentrations in Birds Naturally and Experimentally Infected with *Aspergillus fumigatus*

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Important Findings

Avian aspergillosis, most often caused by *Aspergillus fumigatus*, is a common and devastating disease affecting a range of bird species. Early diagnosis is difficult and often unreliable. The current study evaluated the utility of measuring (1→3)- β -D-glucan (BG) concentrations in avian plasma samples to aid in the diagnosis of aspergillosis. The findings suggest that, although BG concentrations are highly variable between and within different avian groups, it could serve as a useful adjunctive diagnostic test for aspergillosis that is applicable to multiple avian species in some settings, particularly as a negative predictor of infection.

Significance of Findings

The Fungitell assay, measuring BG, appears to be useful as an adjunctive diagnostic for aspergillosis in a variety of avian species. However, the cost of the testing, wide variation of results among avian groups and stages of disease, high baseline BG values in healthy birds, and potential for cross-reactivity may make this test less practical for the average avian practitioner with individual patients. Where the BG assay may be more useful is in the setting of outbreaks in flocks, tracking progression or severity of disease, or in the rehabilitation settings described in this paper, where large numbers of birds are at risk or potentially have disease. Avian BG concentrations were found to be much higher than those found in human samples, indicating a variation in the pathogenesis of disease and the sources of exposure to BG in birds. The utility of the Fungitell BG assay to detect early disease may be limited, but shows promise as a noninvasive confirmatory test, particularly as a negative predictor, when combined with other diagnostic tests and clinical judgment. Additional studies with larger numbers of birds of different species are needed to substantiate the utility of the BG assay as an adjunctive diagnostic test for avian aspergillosis.

Additional Information

Aspergillosis is a devastating fungal disease affecting a variety of avian species. It is caused by infection with one of the ubiquitous saprophytic fungi of the genus *Aspergillus*, most commonly *Aspergillus fumigatus*. Although mammals can acquire aspergillosis, birds are more commonly affected by this organism, likely due to

their unique anatomy, especially in the face of external stressors such as captivity. Some birds, including production, companion, and captive wild birds, are highly susceptible to infection. In production birds such as young turkeys, chickens, and rheas, aspergillosis causes syndromes ranging from acute to chronic respiratory infection to mycotic pododermatitis and neurologic impairment. Prevalence in excess of 8.5%, which is associated with high mortality, has been reported in commercial turkey flocks. Frequently, the infected companion pet birds include African grey and Amazon parrots. Among captive wild birds, raptors are one group that is highly susceptible to infection with *Aspergillus* spp. with some species having specific predispositions; those include goshawks, gyrfalcons, immature red-tailed hawks, and golden eagles. Captive seabirds housed in zoologic institutions and aquaria, as well as seabirds undergoing rehabilitation (especially those recovered in mass numbers during oil spills), comprise another subgroup that is extremely susceptible to this devastating disease.

Due to the prevalence of *Aspergillus* spp. infection in birds, the poor prognosis of infected individuals, and the difficulty in detecting early infection, it is critical to identify diagnostic tests that aid in the early diagnosis of this disease. Historically, to diagnose aspergillosis in birds, avian practitioners have relied heavily on nonspecific markers of inflammation such as plasma protein electrophoresis, white blood cell count, complete blood cell count, and total protein, combined with clinical impressions.

The FDA has approved two commercial enzyme-linked immunosorbent assays (ELISA) that are utilized extensively in diagnosing human invasive aspergillosis via detection of fungal cell wall components. One is the Platelia® test (Bio-Rad Laboratories, Hercules, CA), a sandwich ELISA that detects circulating fungal galactomannan (a component of the fungal cell wall) in serum, plasma, urine, and bronchoalveolar lavage fluid. The Platelia test has been evaluated in some avian species and shows promise as a diagnostic tool. The second FDA-approved test is the Fungitell® assay (Associates of Cape Cod, Falmouth, MA), which is an antigen test that detects circulating concentrations of BG; BG is a major cell wall component of most pathogenic fungi except for *Cryptococcus neoformans* and zygomycetes. This assay has been used widely as an aide in detecting invasive aspergillosis in humans. This is the first avian study evaluating the performance of this assay in both naturally and experimentally infected avian groups. Consequently, the objective of this study was to evaluate the potential diagnostic utility of the Fungitell BG assay in detecting aspergillosis in multiple avian species.