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An Overview of Histomoniasis Challenges Facing the Turkey Industry

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Introduction

Histomoniasis (also commonly known as blackhead disease) is a protozoal disease that causes high mortalities in turkeys. *Histomonas meleagridis* is the etiological agent of this disease and can be harbored in the *Heterakis gallinarum* cecal worm. This roundworm is considered to be the primary transmitter of disease as infected nematode eggs can remain viable in the environment for extended durations of time (McDougald, 1998). However, disease transmission can occur rapidly within a turkey flock via the cloacal drinking phenomenon, whereby reverse peristalsis transfers materials from the vent region into the ceca (McDougald and Fuller, 2005). The *H. meleagridis* first invade the ceca and will then migrate to the liver following degradation of the cecal lining. Lesions are pathognomonic – exhibited as target-like liver lesions and cheese-like, caseous cecal cores.

Chickens are more resistant to histomoniasis than turkeys and frequently may serve as carriers, a primary reason for separate rearing of these poultry species (Cupo and Beckstead, 2019). Morbidity and mortalities in turkeys are high (~70-100%) but no approved therapeutics, prophylactics, or vaccines are currently available to treat histomoniasis since the voluntary removal of Nitarsone in late 2015 (Regmi et al., 2016). According to reported cases in a 2020 survey, histomoniasis is listed in the #11 position of current issues facing the turkey industry (Clark and Froebel, 2020).

Treatment

With the removal of arsenical compounds, several chemoprophylactics have been tested *in vitro* and *in vivo*, with no conclusive success transferred to preventing histomoniasis within live animal studies (Clark and Kimminau, 2017). This leaves a critical need within the turkey industry for new compounds, vaccines, or prevention measures to mitigate histomoniasis. At the University of Arkansas Poultry Health Laboratory, we have evaluated several chemoprophylaxis candidates (e.g., boric acid, deoxycholic acid, sodium chlorate, and sodium nitrate) against histomoniasis. These compounds were noted to exhibit either anti-microbial or anti-fungal properties. Evaluation *in vitro* showed significant anti-histomonal properties, but none of these compounds were effective in reducing incidence of histomoniasis when applied *in vivo* (Barros et al., 2020; Beer et al., 2020a,b). Further research is needed to evaluate and

develop alternatives for reducing incidence of histomoniasis. Efforts are ongoing to establish a repeatable horizontal/lateral transmission model for histomoniasis in order to simulate real-world conditions in a research setting.

Vaccination

Vaccination has been explored as a method of histomoniasis mitigation but yielded limited and variable success (Liebhart et al., 2017). Previous research suggested that oral vaccination of turkeys at day-of-hatch can protect against histomoniasis, which would be a preferable administration route for the turkey industry (Liebhart et al., 2010). However, other research indicated negative results with oral challenge or attempted vaccination via this route; suggesting more research is needed to develop a reliable vaccine for histomoniasis (McDougald, 2005). In our laboratory group, a live-attenuated *H. meleagridis* strain was evaluated as a vaccine candidate in turkeys and resulted in reduced disease severity. Turkeys that were intracloacally inoculated with the vaccine candidate *H. meleagridis* on d14 and then subsequently challenged with a virulent *H. meleagridis* on d28 had lower lesions and mortalities as compared to the turkeys receiving only the virulent *H. meleagridis* challenge. These data suggest that immunoprophylaxis against histomoniasis is possible. Unfortunately, the cost for mass-scale production of a live-attenuated *H. meleagridis* remains a major difficulty to overcome.

Biosecurity

With the absence of approved effective drugs or vaccines for histomoniasis, the prevailing measure for preventing this disease is to minimize exposure to *H. meleagridis.* Histomonads cannot survive for long durations if shed directly into the environment; therefore, worm treatment programs and flock management to prevent *H. gallinarum* and accessory hosts such as earthworms will help to reduce histomoniasis incidence. Moreover, limiting exposure to mechanical vectors such as rodents, insects, or contaminated litter are critical to eliminating potential contamination.

Conclusion

Biosecurity measures to prevent exposures to *H. meleagridis* and infected nematode ova are important to reducing the incidence of histomoniasis within turkey flocks. Contact between turkeys and other birds such as chickens should be minimized (e.g., separate rearing is necessary) since other galliformes can harbor *H. meleagridis* without exhibiting clinical signs of disease. In the absence of vectors/reservoirs, the spread of *H. meleagridis* will be greatly reduced as the protozoa will die quickly when freely exposed to the environment. Alternative compounds (e.g., plant-derived or chemical) and vaccination methods to mitigate histomoniasis are critical for the turkey industry. Further research is being conducted within industry and academia to elucidate disease mechanism, prophylactic, and therapeutic options for histomoniasis.

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