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Mini Review

Preliminary Disease Survey of Domestic Ruminants on Farasan Islands, Saudi Arabia

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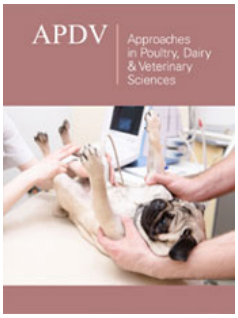

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The Farasan Islands are situated in the Red Sea in southwestern Saudi Arabia [1]. The climate is arid with low and highly variable annual rainfall [2]. Although there are more than 300 islets, only the two largest Farasan Kebir (381 km^2) and As Saqid (149 km^2)–are permanently inhabited by humans [1] and a prevailing fishing culture has led to the absence of intensified livestock keeping. In recent years, tourism on Farasan Islands has grown significantly, leading to an enhanced demand for goat and sheep products, and therefore an increase in livestock numbers. Counts on Farasan Kebir estimated 1330 individuals, corresponding to a density of 3.5 sheep/goat per km^2 [3]. In 1988 the Farasan Islands were gazetted as a protected area for the conservation of the archipelago's outstanding marine diversity and for its unique population of Arabian gazelles [2]. Arabian gazelles are threatened with extinction in Saudi Arabia and are classified as "vulnerable" by the IUCN Red List [4]. The current population of *G. arabica* on the Farasan Islands is estimated to be about 700 individuals. The Farasan population is probably the largest in the world, and thus deserves particular conservation attention [5]. The emergence of zoonotic disease in humans and their domestic livestock and the interface between domestic animals and wildlife populations has become increasingly important in recent years, especially for species of high conservation value (the One Health approach, [6-8]). Both *Toxoplasma gondii* and *Brucella* spp. are globally distributed zoonotic pathogens that infect a wide range of warm-blooded animals and cause life-threatening infections in fetuses and immune-compromised adult hosts [9]. Both pathogens are also common causes for abortion in goats, sheep and wild ruminants [10,11]. However, only a few reports address the presence of *Toxoplasma gondii* and *Brucella spp*. in wild and domestic animals in Saudi Arabia [12,13]. Worldwide feed, water and mineral sources are often shared between species contributing to the reemergence of brucellosis and toxoplasmosis in livestock and wildlife [14,15]. Although, *Brucella* spp. cannot multiply outside of its mammalian hosts it can remain viable within the environment for a short time, confined by high temperatures, dryness, and direct exposure to sunlight. The epidemiological importance of environmental contamination as a source of *Brucella* spp. infection in wildlife species therefore depends largely on local conditions. For the Farasan Islands and their particularly harsh environment it is assumed that environmental contamination with *Brucella* spp. lasts only for a few days.

Toxoplasmosis is thought to be transmitted via oocyst ingestion from an environment contaminated with feces of infected feral cats [16]. In a large feral cat population, fecal deposition was estimated at 107 metric tons/year, resulting in 244 billion oocysts shed by feral cats annually [17-18]. Feral cats are common on Farasan Islands and tolerated by the local community. Since feral cats frequently roam the commonly used foraging habitats of wild and domestic ruminants on Farasan Kebir, it can be assumed that gazelles have a similar risk of infection (and thus similar seroprevalence) compared to domestic livestock. Surveys of *Toxoplasma gondii* infections in domestic animals can provide estimates of environmental contamination and of possible effects on ecologically and behaviorally similar wildlife species [19]. Dabritz et al. [20], for example, found similar seroprevalence in three sympatrically occurring canid species in Indiana, USA.

We thus propose that the risk of toxoplasmosis infection in Farasan gazelles can be indirectly inferred by testing domestic sheep and goats. A major concern of wildlife managers is to prevent the introduction of an infectious disease into a wild population, particularly into sensitive ecosystems such as those found on isolated islands. We thus implemented a preliminary disease survey of domestic livestock on Farasan Islands by testing sera from 225 domestic ruminants (62 sheep and 163 goats) for the presence of antibodies against *Toxoplasma gondii* and *Brucella* species. Toxoplasma was tested using a commercially available agglutination test, while *Brucella* spp. were tested using a standard qualitative card test (Brucelloslide-test, bioMérieux) and confirmed by ELISA (COMPELISA-400, AHVLA). *T. gondii* seroprevalence was 33.8% (21/62) in sheep and 54% (88/163) in goats. *Brucella* spp. seroprevalence was 0% for domestic sheep and 0.6% (1/163) for goats. The high *T. gondii* seroprevalence indicated a widespread exposure of domestic ruminants to *T. gondii*, and thus is also of epidemiologic significance for the Arabian gazelle population on the archipelago. Established seroprevalence of *Brucella* spp. was low, as predicted for a hyper-arid environment. The Farasan gazelle population is characterized by a relatively high population density [21,22]. Coupled with its limited geographic distribution (mainly on Farasan Kebir), makes the population particularly vulnerable to stochastic events, such as disease outbreaks [23]. The uncontrolled expansion of feral cats on Farasan Kebir has presumably led to the high prevalence of *T. gondii* in domestic livestock, thus resulting in more oocysts in the environment and raising the risk of toxoplasmosis transmission to humans, domestic livestock, and wildlife. Although cats are typically infected only once before gaining immunity, the huge number of free-ranging cats is enough to maintain a large volume of oocysts on the island [24,25]. Reducing the number of feral cats by reducing their breeding capacity of its population (e.g., spay and neutering) is an important toxoplasmosis prevention measure, which, together with continuous intensive disease surveillance, may help to protect this gazelle population from disease outbreaks that could compromise the success of ongoing conservation efforts. The use of a vaccine for brucellosis control should be also considered, but no brucellosis vaccine that gives satisfactory results in terms of safety and efficacy in wildlife species, is currently available [26]. Excerpts of this article were published in [26-28].

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