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CRYPTOSPORIDIUM SPECIES AND CATTLE: IMPLICATION FOR PUBLIC HEALTH AND WATER.

SHORT COMMUNICATION

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ABSTRACT

*This paper presents a brief summary of the ecology of **Cryptosporidium** species in Calves and humans and the existing scientific evidence that addresses the claim that calves put humans at significant risk for water–borne infection of **Cryptosporidium** species. **Cryptosporidium** species is a tiny protozoon that can cause gastrointestinal illness in a variety of mammals, including humans, Cattle, Sheep, goats, pigs, and horses. The infection in Calves and humans is primarily transmitted by fecal-oral route. The evidence supporting the claim that Cattle are a significant source of **C. parvum** for surface water and human infection is incomplete and contradictory in some cases. It would be premature at this time to claim that Cattle production is the leading source of **C. parvum** in surface waters. It is necessary therefore to identify in addition to Cattle, the primary quantitative source(s) of this parasite in the environment, be it companion animals, human associated sewage effluent, livestock, or humans.*

Key words: Cryptosporidium, gastrointestinal illness, contamination, oocysts, shedding, cattle, humans

The genus *Cryptosporidium* is composed of protozoan parasites that infect epithelial cells in the microvillus border of the gastrointestinal tract of all classes of vertebrates. They are found world wide. Effects of infection vary with the species of *Cryptosporidium*. Some species of *Cryptosporidium* infect many host species, whereas others are restricted to groups such as rodents or ruminants, and still others are known to infect only one host species. *Cryptosporidium* species is a tiny protozoon that can cause gastrointestinal illness in a variety of mammals, including humans, Cattle, Sheep, goats, pigs, and horses (Abe *et al*., 2006, Adesiyun *et al.,* 2001). It also occurs in various Wildlife species. In cattle, clinical disease and shedding of the parasite is usually limited to calves under a few

months of age, but there are a few report of subclinical shedding of the parasite in adult Cattle from researchers in England, US and Africa. In humans, clinical disease and shedding appears to be in all ages, but is most common among children. The predominant clinical sign is profuse watery diarrhea lasting upto several weeks in normal patients (immuno-competent) calves and humans (Anderson *et al.,* 1998, Angus *et al.,*1990). While this disease is usually self-limiting in immuno-competent calves and humans, it can be prolonged and life threatening in immuno-compromised people such as AIDS patients since an effective treatment for eliminating this parasite from the gastrointestinal tract still don't exist. Few antibiotics may show some promised in reducing the amount of oocyst shedding in AIDS patients, further clinical trials to fully evaluate their efficacy. The lack of effective treatment and the fact that this parasite was implicated in recent large scale waterborne outbreaks of gastroenteritis in humans(e.g.,400,000 suspect cases in Milwaukee,Wisconsin,1993;13000 suspect cases in Carrollton, Georgia, 1987)has prompted public health officials and state and federal agencies to consider ways to reduce drinking water contamination by this parasite. Some of this is to focus on identifying the primary sources of *Cryptosporidium* contamination in water. Presented below is a brief summary of the ecology of *Cryptosporidium* species in Calves and humans and the existing scientific evidence that addresses the claim that calves put humans at significant risk for water –borne infection of *Cryptosporidium* species (Aldom *et al.*, 1995, Borchardt *et al.,* 2002).

The infection in Calves and humans is primarily transmitted by fecal-oral route. Infection typically begins when a susceptible individual ingests water or food contaminated by the oocyst of this parasite. The parasite then invades the epithelium of the intestine, replicates, and through sequential reproductive cycles can result to a lot of oocysts being shed in the feces per day. Shedding of oocyst can last from 3-12days in calves and an average of 18days in humans. Given the large number of oocyst shed per day, the immediate environment can become quite contaminated with these oocysts. These oocysts are immediately infective to another individual, allowing for the rapid spread of the parasites within a group of susceptible individuals (Casemore *et al.,* 2006, Current *et al.,* 1985).

Ocyst shed from one species of mammal appear to be infectious to others, oocysts from humans has been shown to be infectious to lambs, calves, dogs and goats. Oocyst from cats, calves and pigs appear to be infectious to humans. People working with diarrheic calves infected with *Cryptosporidium* species have themselves become infected with *C. parvum*, presumably from the calf. However, working with diarrheic calves is not common for the general public. Another *Cryptosporidium* species: *C. muris* has been identified in the abomasums of adult cattle, but to date it has not been shown to be effective to humans (Fayer *et al*., 1993, D'Antonion *et al.,* 1985).

The critical issue is how would *C. parvum* from calves gain access to surface waters and end up in drinking water supplies. The essential steps must include calves becoming infected and shedding the oocysts in their feces. These oocysts then enter a surface water supply and remain infective as they journey downstream to water treatment and distribution systems (Bendali *et al.,* 2007, Crowthe *et al.,* 2001, Fayer *et al.,* 1998, Pam and Owuliri, 2008; Pam *et al*. 2009a, b).

How common is it for calves with access to surface water shed this parasite? Very little work has been done in beef calves, with most research conducted on dairy calves. The largest survey to date on shedding of *Cryptosporidium* in beef calves was conducted in the USA, by the National Veterinary service in which 20% of diarrheic calves and 11% of non diarrheic calves were found to be shedding *Cryptosporidium* oocyst at the time of sampling. In this same study shedding of oocyst was documented in 9% of asymptomatic calves between 3 and 6 months of age, indicating that shedding can occur in these older age groups and without clinical sign, In England 36- dairy calves: 39% of diarrheic beef calves tested positive. In San Bernardino county, California, 5.6% of predominately Holstein dairy calves were found to be shedding *C. parvum*. More specifically, the prevalence of shedding was 21% in calves with diarrhea and 2% in healthy calves. This parasite appears to be more common in diary calves, but more information is needed on the distribution of *C. parvum* in shedding in beef cattle herds located in open range with access to water sources (Current *et al.,* 1985, Fleisher *et al.,* 1998, Hsu *et al.,* 1999, Rose *et al.,* 1988, 1997, 1991).

Little is known about the prevalence of shedding among Wildlife species with access to surface waters or what contribution humans themselves make to surface water contamination. The prevalence of shedding among groups of people depends on which country or population, and this can range between 0-60%, with the higher proportion of shedding among diarrheic individuals. Oocysts that dry out appear to become non-infective in just a few hours. If fecal material; thoroughly dries before reaching water, the oocyst would be non infective for both humans and animals Ten or more days of freezing causes over 90% of oocyst to become non-infective, Oocyst in distilled water becomes non-infective if heated to 72.40C or higher for one minutes or if heated for 64.20C or higher for 2 minutes. Looking at the situation of oocyst in steam water, one study reported that after 33days in river water, an estimated of 34-40% of purified oocysts were incapable of excystation. After 176 days, 89-99% was estimated to be incapable of excystation. It can be presumed that most oocysts do not remain infective as they journey from calves to surface water to treatment plants to human consumption (WHO, 2006, APHA, 1992, CDC, 1990).

What evidence directly links the *C.* species in surface water supplies to livestock production and humans? Environmental studies to date have had a difficult time in determining *Cryptosporidium parvum* found in surface water is *C. parvum* or some other *Cryptosporidium* species not infectious to humans yet detected by one of the laboratory assay used for environmental testing. With this in mind, a study carried out in Jos, the Northern parts of Nigeria reported 32% of the water collected from rivers, lakes and ponds were found to have oocysts (Njoku *et al*; 2005) in comparison, Rose *et al* (1997) found no difference in the concentration of *Cryptosporidium* oocyst from protected surface waters as compared to surface waters subjected to agricultural run-off (0.1-2.0 oocyst/L) and 68% of these oocyst had become non viable. As few as 30 oocysts can induce infection. Although there are several environmental factors that will make oocyst when excreted to remain infective on land, apparently, only a few oocysts would

need to remain viable in drinking water to pose a risk to humans. In conclusion, the evidence supporting the claim that Cattle are a significant source of *C. parvum* for surface water and human infection is incomplete and contradictory in some cases. It would be premature at this time to claim that Cattle production is the leading source of *C. parvum* in surface waters. It is necessary therefore to identify in addition to Cattle, the primary quantitative source(s) of this parasite in the environment, be it companion animals, human associated sewage effluent, livestock, or humans.

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