

Ancillary Therapies for Calf Diarrhea: Medical use of Kaolin

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History

Kaolin (a hydrated aluminum silicate powder) has been used for treating gastrointestinal and other ailments in humans and animals since pre-historic times (Williams and Hillier, 2014).

Pharmacokinetics and potential mechanism of action

Kaolin is a clay molecule with a three dimensional structural arrangement which forms voids and channels that can trap a wide variety of molecules. Clays decrease the passage time of foods in the digestive tract and thereby increase nutrient digestion. Clays also cause changes in intestinal mucosa (increased villus height to crypt depth ratio) and increase surface area for nutrient digestion (Subramaniam and Kim, 2015). Clay molecules including kaolin are reportedly attracted to gastrointestinal mucosa and form a coat; hence prevent toxins and pathogens from being absorbed. The internal surface area of clays (kaolin) is also thought to adsorb bacteria and toxins resulting in transportation and elimination of kaolin-pathogen or kaolin-toxin complex through the gut (Williams and Hillier, 2014).

KEY POINT

Kaolin and other clay products are not recommended for treatment of acute diarrhea and treatment with these may result in some unwanted side effects.

Clays are thought to decrease incidence, severity and duration of diarrhea in pigs by increasing the number of *Bifidobacteria* and *Lactobacillus* and by reducing *Clostridia* and *Escherichia coli* (Subramaniam and Kim, 2015). The space between layers of clay expand to absorb water and cations; hence treated animals have more formed stool. Clays have been documented to alter the microbial population in the gastrointestinal tract. Ion exchange by clays is thought to modify intestinal environmental conditions such as pH, oxidation; hence favoring certain bacteria (Williams and Haydel, 2010).

The most common formulation for kaolin was as Kaopectate. However, kaolin was replaced with attapulgite clay in the 1980's. In 2003 the US FDA found that there was not enough scientific support for the use of attapulgite in treating diarrhea in people and disallowed its use in diarrhea medications (US FDA 2004). Kaopectate and similar products no longer contain kaolin but may contain bismuth subsalicylate (not to be used in cats). Some veterinary formulations may still contain kaolin. The side effects to clays include constipation, particularly in the young, and decreased absorption of some medications, such as antibiotics. ***Confusion about what is in the anti-diarrheal products cautions practitioners to read the label for the active ingredients.*** The primary concern is efficacy of these products which led to the discouragement of their use in pediatric diarrhea (Thielman and Guerrant 2004).

Evidence, knowledge gap and future research

Whereas several studies in pigs provide some evidence for the beneficial effects of kaolin in reducing severity and duration of diarrhea, overall, randomized controlled blinded clinical trials are needed to ascertain the efficacy of kaolin in treating nonspecific and specific diarrhea.

Drug	Study type	Main findings and/or mechanism of action	Reference
Kaolin suspension, pectin suspension, kaolin/pectin concentrate	Clinical trial in 3-11 year old children in Guatemala hospitalized for diarrhea	Children treated with kaolin-pectin for 2 days had more formed stools than controls, but overall these agents were ineffective in treating acute diarrhea.	Portnoy et al., 1976
Kaopectate containing kaolin/pectin	In vivo	50% kaopectate reduced fluid secretion in ligated pig intestines infected with entero-pathogenic <i>Escherichia coli</i> P155.	Gyles and Zigler, 1978
Kaolin/pectin	Review	Improved stool consistency but didn't reduce loss of fluids or ions. A study in rats -- animals lost 185% more potassium and 103% more sodium compared to controls. Use was not recommended for treatment of neonatal diarrhea in humans or calves.	Roussel and Brumbaugh. 1991; Ludan, 1988
Kaolin/pectin	Review	Kaolin/pectin had some beneficial effect in reducing nonspecific diarrhea.	Ericsson, 2005
Kaolin/pectin	Review	Efficacy studies in calves are lacking. Not recommended for treating calf diarrhea.	Constable, 2009
1% kaolin	Clinical trial in weaned piglets experimentally infected with enterotoxigenic <i>E. coli</i> (O141:F18ac)	Kaolin treated piglets had reduced colonization and fecal shedding, and mild diarrhea with short duration compared to controls. Conclusion: kaolin had protective effect in reducing diarrhea due to ETEC (O141:F18ac).	Trckova et al., 2009
Dietary clays including kaolinite	Randomized blocked clinical trial in weaned pigs experimentally infected with pathogenic <i>E. coli</i>	Treated pigs had reduced diarrhea score, reduced frequency of diarrhea and β fecal hemolytic coliforms compared to controls. Their conclusion: Dietary clay was effective in reducing diarrhea and could be used for preventing diarrhea.	Song et al., 2012

Dietary clays including kaolinite	Review	Reduced incidence and duration of diarrhea in pigs.	Subramaniam and Kim, 2015
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Conclusions

Although kaolin and other clay use will improve stool consistency, and some specific use for it in ETEC in pigs, it is not recommended for treatment of calves with acute diarrhea because of the potential for additional loss of electrolytes and the false sense that the calf is “cured” because the feces are firmer. In addition, the formulations of these antidiarrheals have changed over the years and practitioners should help clients read the labels and select the appropriate medications.

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