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Comparison of Conjunctive Probiotic Use Versus No Probiotic Use in Outcomes of Antibiotic-Associated Diarrhea

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Abstract

Antibiotics are utilized in the medical community for the treatment of bacterial infections. Consequently, the use of antibiotics may result in certain gastrointestinal side effects. Antibiotic-associated diarrhea is one side effect that can be seen in patient populations that are on an antibiotic regimen. Due to this side effect profile, patient compliance on an antibiotic regimen may be compromised. This lack in patient compliance led to increased interest to determine if there are treatment options available to prevent or reduce instances of antibiotic-associated diarrhea. One treatment option of interest includes the use of probiotics. The purpose of this literature review is to determine if conjunctive use of probiotic supplementation during an antibiotic regimen demonstrates protective effects in preventing or reducing the instance of antibiotic-associated diarrhea. Studies that were included analyzed probiotic use versus a placebo in treatment of antibiotic-associated diarrhea in pediatric, adult, and elderly populations in an outpatient or inpatient clinical setting. The data available at this time suggests that supplementing with probiotics during an antibiotic regimen may be effective in prevention and reduction of antibiotic-associated diarrhea in pediatric and adult populations

Introduction

- Antibiotics play an important role in fighting off bacterial infections.
- Antibiotics may also destroy important symbiotic bacteria that reside in the human intestinal tract.
- A common adverse effect of antibiotics includes antibiotic-associated diarrhea.
- Benefits of these symbiotic bacteria are crucial for the maintenance of human health.
- Research has been designed to explore various treatment methods to combat the destructive nature of antibiotics.
- One treatment method includes the use of probiotic supplementation during and after an antibiotic regimen.
- Probiotics are a variety of live microorganisms that have been identified as beneficial to the human body.
- Examples of microorganisms used in many probiotic supplements include the genera *Lactobacillus* and *Bifidobacterium*.
- The purpose of this research is to investigate whether supplementing the human intestinal tract with probiotic microorganisms will have a positive influence in reducing the adverse effects that occur with antibiotic use.

Statement of the Problem

- Antibiotic-associated diarrhea is a common manifestation in the clinical setting due to the abundant use of prescription antibiotics to treat various bacterial infections.
- Between 1 and 40% of patients taking an antibiotic will report an incidence of antibiotic-associated diarrhea (DynaMed, 2018).
- Understanding possible effective therapies to treat this common clinical manifestation is pertinent to current medical practice.
- Knowing whether this therapy method would be an appropriate option for medical providers to incorporate in their daily medical practice would be beneficial.

Research Question

- In patients on a current antibiotic regimen, is there a statistically significant difference with conjunctive use of prescription probiotics versus no probiotic use in the reduction of antibiotic-associated diarrhea?

Literature Review

Prevalence of Antibiotic-Associated Diarrhea

- Evans et al. (2016) determined that a 7-day course of twice daily Augmentin resulted in an increase in Bristol Stool Scale (BSS) scores and antibiotic-associated diarrhea in both the probiotic and placebo groups.
- With a specific focus on the pediatric population, Olek et al. (2017) concluded that 44.5% of the placebo group and 39% of the probiotic group experienced loose and watery stools during an antibiotic regimen.

The Efficacy of Probiotic Use Versus Placebo During an Antibiotic Regimen in Reduction of Antibiotic-Associated Diarrhea

- Blaabjerg et al. (2017) concluded that the group receiving probiotic supplementation resulted in a decreased incidence of antibiotic-associated diarrhea with a pooled result of 8.0% of participants compared to the placebo group of 17.7% incidence (shown in figure 2).
- A Cochrane review conducted by Guo et al. (2019) found a statistically significant protective effect of probiotic supplementation against antibiotic-associated diarrhea in the pediatric population (shown in figure 2).
- Similar results were found by Szajewska et al. (2006) in that probiotic supplementation resulted in a statistically significant reduction of antibiotic-associated diarrhea in the pediatric population. The significance was impacted by the strain of probiotic utilized (shown in figure 2).
- Hempel et al. (2012) and Videlock and Cremonini (2012) found that the use of probiotics was associated with a lower relative risk of experiencing antibiotic-associated diarrhea compared to the placebo group.
- In an inpatient setting, Selinger et al. (2013) concluded that probiotic supplementation prevented antibiotic-associated diarrhea with 11.4% of the placebo group experiencing diarrhea compared to 0% of the probiotic group (shown in figure 2).

The Effect of Probiotics on Duration, Frequency, and Gastrointestinal Symptoms Related to Antibiotic-Associated Diarrhea

- Blaabjerg et al. (2017) found a reduction in the mean duration of diarrhea in the probiotic group with an average of 2.93 days compared to 4.65 days in the placebo group (shown in figure 1).
- Szajewska et al. (2006) also found a reduced mean duration of diarrhea in the probiotic group with an average of 1.18 less days than the placebo group (shown in figure 1).
- Olek et al. (2017) and Evans et al. (2016) both indicated that there were no differences found between probiotic and placebo groups in frequency of gastrointestinal symptoms, such as constipation, abdominal discomfort, or indigestion.

The Variability in Type of Organism and Dosage of Probiotics and the Influence in Overall Effectiveness

- The probiotic strains, *Lactobacillus rhamnosus* GG and *Saccharomyces boulardii*, were found by multiple studies to be the most effective strains in reducing antibiotic-associated diarrhea.
- A dosage of 5 billion colony-forming units (CFUs) or greater resulted in a statistically significant protective effect against antibiotic-associated diarrhea.

The Variability in Outcomes Between Age Groups

- Johnston et al. (2006) and Szajewska et al. (2006) both found a statistically significant reduction in antibiotic-associated diarrhea with probiotic use in the pediatric population.
- Xie et al. (2014) concluded that probiotic supplementation did not result in reduction of antibiotic-associated diarrhea in the elderly population.
- There are no variations in overall effectiveness of probiotic supplementation between the pediatric and adult populations. Both experienced a lower incidence of antibiotic-associated diarrhea (Videlock & Cremonini, 2012).

Discussion

- The results of this literature review indicate that conjunctive use of probiotic supplementation during an antibiotic regimen demonstrate a statistically significant reduction in the overall instance of antibiotic-associated diarrhea.
- The efficacy of probiotics in reduction of antibiotic-associated diarrhea is influenced by type of strain and dosage of probiotic. The two strains of probiotic found most statistically significant in multiple studies include *Lactobacillus rhamnosus* GG and *Saccharomyces boulardii*.
- In reference to dosage, it was consistent that an amount of 5 billion CFUs or greater resulted in a clinically significant protective effect.
- The variability in outcomes based on age is notable. Both pediatric and adult populations experienced the most reduction in antibiotic-associated diarrhea with probiotic supplementation. The elderly population did not experience such benefits.
- Limitations that exist with probiotic supplementation include the effect on specific gastrointestinal symptoms. Probiotic use did not result in a statistically significant difference in the incidence or frequency of gastrointestinal symptoms.
- Further research is required to determine the safety and efficacy of probiotics in all patient populations in different clinical settings.

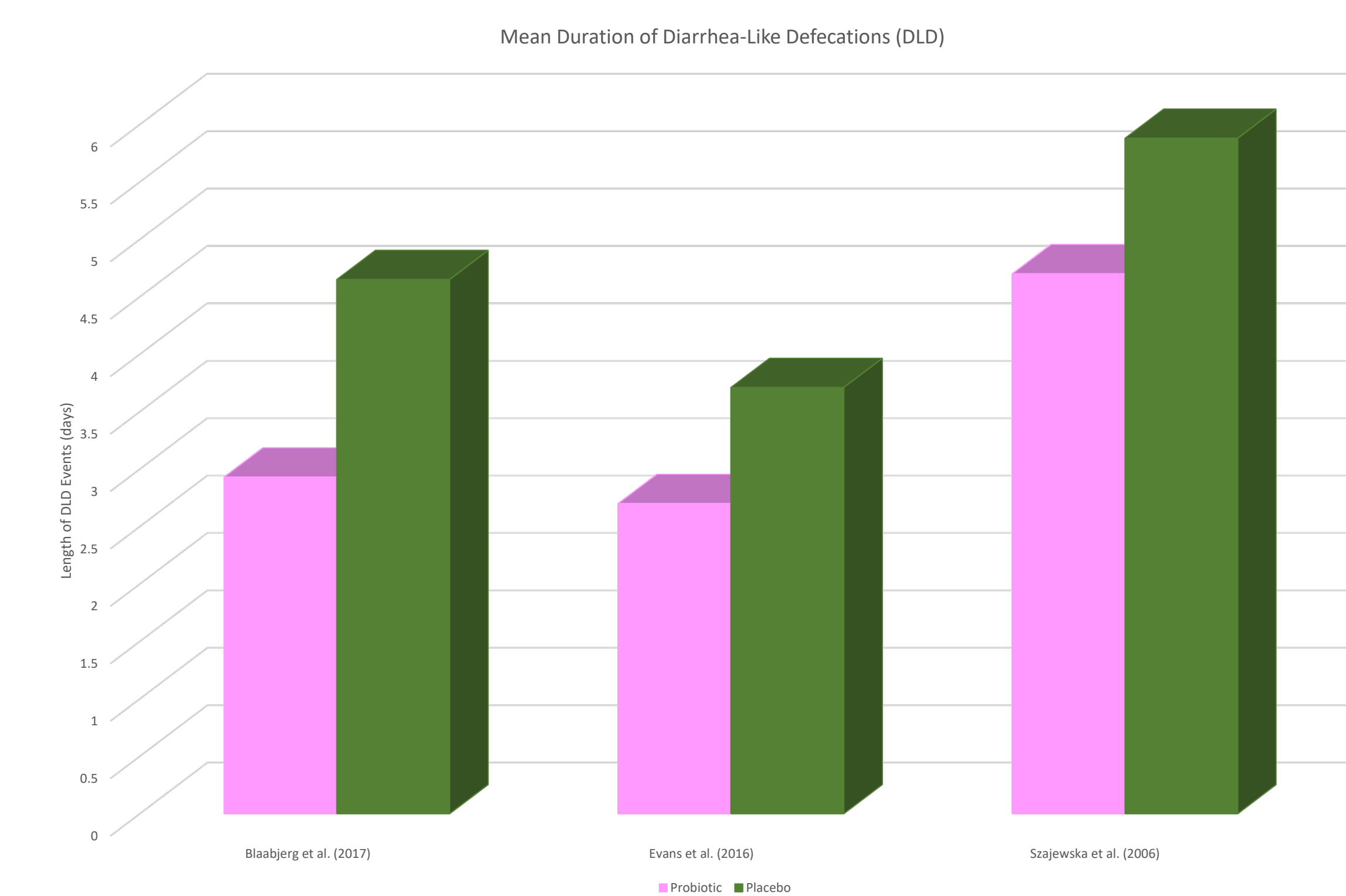


Figure 1. Original figure created on October 06, 2020.

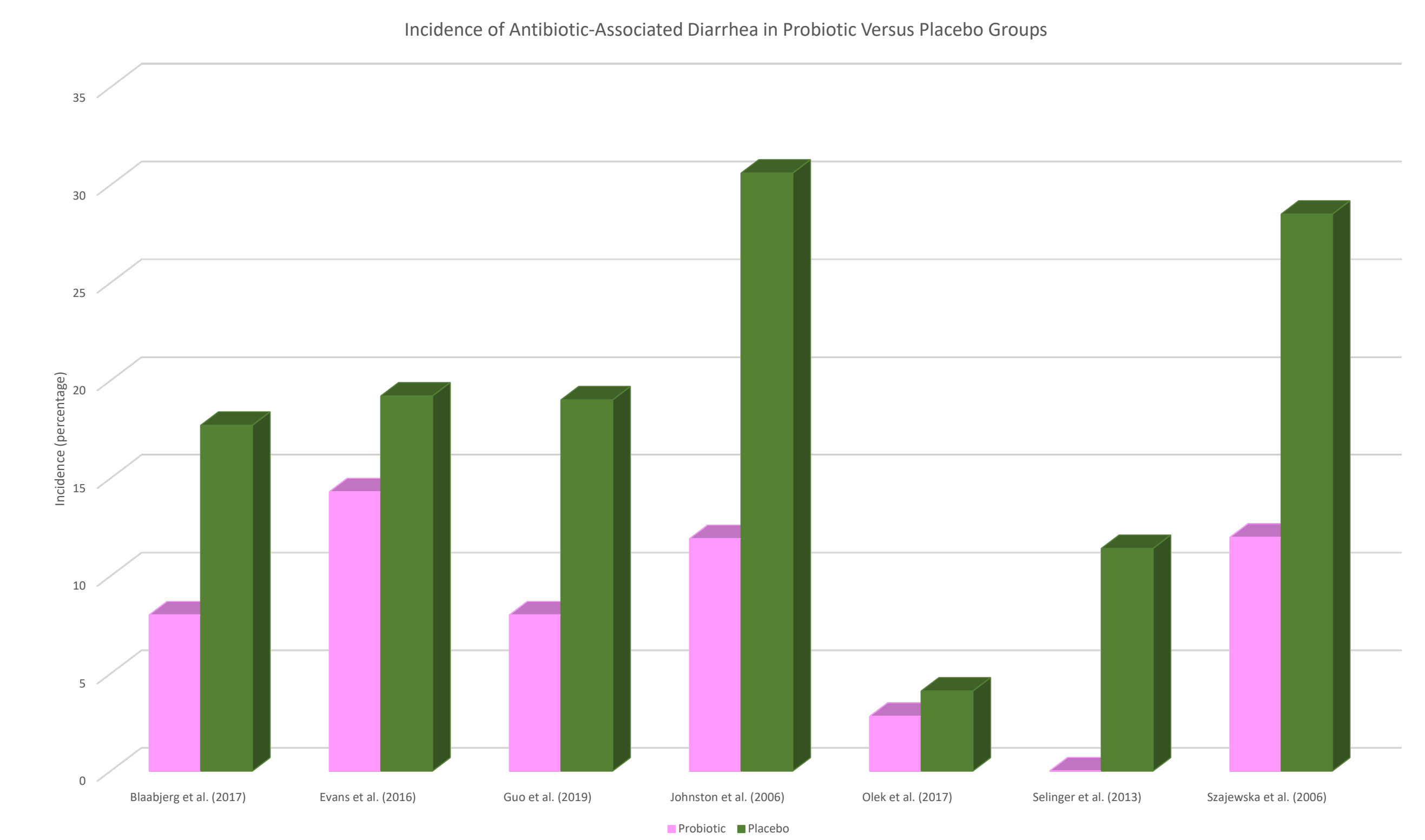


Figure 2. Original figure created on October 6, 2020.

Applicability to Clinical Practice

- The information that is provided in this literature review will assist medical providers in making an evidence-based decision on whether to include probiotic supplementation during an antibiotic regimen to reduce the occurrence of antibiotic-associated diarrhea.
- The use of probiotics offers a potentially effective method to treat a common adverse effect of antibiotic use. This may aid medical providers in improving patient satisfaction and compliance with treatment.

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