Introduction

Human gastrointestinal tract is a specific ecosystem inhabited by more than 400 diverse microbial species living in perfect natural balance. These are the species that have been isolated and defined so far and they are present in the concentration higher than $10^{14}$ organisms/g (Šušković and Kos, 2000). The function of intestinal microbial population within gastrointestinal tract is multiple, whereas protecting organism is considered to be its most important function (Vaughan et al., 2000; Falagas et.al., 2008). During the 70’s of the 20th century, scientific researches provided sufficient firm evidence that the balance among diverse microbial species within intestine population is a precondition for the preservation of human health.

Due to growing pollution of the environment, use of chemical food additives, frequent international travels, as well as antibiotic treatments and radiotherapy, intestinal population can be misbalanced. Regardless of sample, the most frequent consequence of such misbalances is diarrhea, a disease that nearly 4 billion people suffer from per year. 5 % of all people on sick-leave suffer from diarrhea. Furthermore, about 4 % of the diarrhea inflicted population die because of its consequences (Szajewska and Mrukowicz, 2005; Sazawal et al., 2006). In developing countries, diarrhea caused by pathogen strains Shigella, Vibrio cholera, Salmonella, Campylobacter spp., Escherichia coli and rotaviruses are major cause of infants and child mortality. However, even in developed countries, such as the USA, diarrhea is diagnosed in 21 to 37 million cases per year within the population of 16.5 million children (Nomoto, 2005). Traveller’s diarrhea is found in approximately 12 million cases, and depending on destination, 5 to 50% travellers suffer from it (Cheng and Thielman, 2002; McFarland, 2007). Diarrhea often happens during or after antibiotic treatment (5-25 %) or X-ray treatment of people suffering from cancer (Bergogne-Berezin, 2000). Due to the fact that more than a half of world grown-up population have insufficient quantity of lactase enzyme, diarrhea can be caused by consuming food in which lactose share is almost 50 g. The figure of the real lactose intolerance of the population is not fully accurate when commonly consumed quantity of milk of 2.5 deL (12 g of lactose) is taken into consideration. It is considered to be less for a half (Miller et al., 2007).

Lactic acid bacteria and bifidobacteria are characterized by ability to create diverse organic compounds and acids, hydrogen peroxide, diacetyl, CO2, bacteriocine which they secrete into their habitat where they grow (Tamime et al., 2006). Either food or digestive tract being considered, these microorganisms have mainly inhibitory impact on the growth of undesirable microbial population for humans (Rogelj and Bogović-Matijašić, 1994; Šušković et al., 1997; Šušković
et al., 1998; Samaržija et al., 2001, 2001a). Therefore it is no surprise that the data from numerous researches prove that, apart from their nutritional value, fermented milks have direct and/or indirect health-related value (Lukač Havranek and Samaržija, 1996). Fermented milks or preparations of lactic acid bacteria and bifidobacteria in the shape of capsule are proved to have beneficial effects in the prevention or as supplement in treatment of many different diseases (gastrointestinal, urogenital infections, tumours) (Blom and Mortvedt, 1991; Strnad and Babuš, 1996; Ouwehand et al., 1999; Betica-Radić, 2000; Sleatord and Hill, 2007).

In the prevention and therapy of diarrhea caused by misbalance within intestinal microbial population, the use of probiotic lactic acid bacteria and bifidobacteria in particular cases has also turned out to be a good choice. To a greater or less extent they are capable of re-establishing natural microbial balance in intestines (Bergogne-Berezin, 2000; Schrezenmeir and de Verse, 2001; Šušković et al., 2001).

The aim of this research is to emphasize the most important results obtained in about past ten years of probiotic bacteria preventive and therapeutic influence on: acute diarrhea in children, traveller’s diarrhea, antibiotic associated diarrhea, radiotherapy and lactose intolerance.

Acute diarrhea in children

The largest number of cases of acute diarrhea in children is a result of infection by rotaviruses. Because of that, it is no surprise that researches on the probiotic bacteria effect in prevention and therapy of diarrhea is connected with rotaviruses to a great extent. Thus a study, comprising children from one month to 36 months of age, showed that the usage of probiotic lactic acid bacteria and/ or bifidobacteria on daily basis, not depending on whether these organisms were part of fermented milks, capsule or oral rehydration solution, decreases duration of diarrhea for 30-40 % (Saavedra, 2000).

In the group of children who were taking probiotics, diarrhea lasted for 1.4 to 2.3 days whereas in the placebo group diarrhea lasted for 2.4 to 3.2 days (Isolauri et al., 1991; Boudra et al., 1996; Shornikova, 1997; Guandalini et al., 2000; Weizman et al., 2005). The probiotic strains of bacteria Lactobacillus rhamnosus GG, Lactobacillus reuteri, Lactobacillus delbruecki subsp. Bulgaricus, Bifidobacterium lactis and Streptococcus thermophilus not only have therapeutic effect, but also have preventive effect on the manifestation of acute diarrhea in children. In the 17-month study, carried out in 1992 and 1993, only 7 % of the infants who were fed with infant formula enriched with Bifidobacterium bifidum and Streptococcus thermophilus bacteria had diarrhea. The manifestation of acute diarrhea during the same research period was 31 % with the babies fed with standard infant formula. However, the gravity of diarrhea, measured by its duration, frequency and stool quantity, has no significant difference among the test groups (Saavedra et al., 1994). Conversely, the results of the 2-year study (2000-2002) show that probiotic bacteria Bifidobacterium lactis and Lactobacillus reuteri in the concentration of 10^7 cfu/g decrease the prevalence of diarrhea in infants as well as its duration. However, more beneficial probiotic effect on the manifestation and duration of diarrhea was determined for Lactobacillus reuteri (Weizman et al., 2005). Shorter duration of acute diarrhea up to 48 % was determined by Rosenfeldt (2002) in the cases when the children were consuming Lactobacillus reuteri DSM 12246 (10^10 cfu) along with Lactobacillus rhamnosus 19070-2 (10^10 cfu/g) on a daily basis. Acute diarrhea was considerably eased in hospitalized children aged from one month to three years who were given Lactobacillus rhamnosus GG (10^10 cfu/g) on a daily basis. Therefore, diarrhea was registered in 7-10 % of infants, whereas in the placebo group it was registered in even 33 % of cases (Szajewska et al., 2001; Mastrettta et al., 2002).

After acute diarrhea in children caused by diverse infectious agents, the ability to colonize intestines with Lactobacillus rhamnosus GG bacterium was confirmed in 78.6 % (virus infection), in 75 % (bacterial infection) and in 85.7 % (unknown etiology) of cases (Szymanski et al., 2006). Therapeutic concentration (10^10 cfu/g) contained three different strains of Lactobacillus rhamnosus GG in ratio 1:1:1.

Traveller’s diarrhea

Due to contradictory results it is still not possible to talk for sure about the definite efficiency of probiotic bacteria usage in prophylaxis of traveller’s diarrhea. The researches carried out in the 90’s proved that probiotic strains Lactobacillus acidophilus alone or combined with Lactobacillus fermentum and Lactobacillus delbruecki subsp. bulgaricus do not have considerable effect on prevention and/or ease of diarrhea (Kollaritsch et al., 1989; Katelaris et al., 1995). These results were confirmed by Briand (2006) in a double blind randomised study which has shown that Lactobacillus acidophilus (10^10 cfu/g) taken two times a day before and after travelling does not prevent diarrhea. On the other hand, lyophilized mixed probiotic culture composed of Lactobacillus acidophilus, Lactobacillus delbrueckii subsp. bulgaricus, Bifidobacterium bifidum, Streptococcus thermophilus in the concentration of 3x10^7 cfu/g, which was consumed on the same way by Danish tourists during two weeks of journey through Egypt, reduced prevalence of diarrhea from 71 % to 43 % (Black et al., 1989). Meta analysis of six studies conducted by Szazwal et al. (2006) has shown that probiotic strains of bacteria Lactobacillus acidophilus, Lactobacillus delbrueckii subsp. bulgaricus Lactobacillus
Radiation-induced diarrhea

Radiotherapy is a method used very often in a medicine for treatment of different types of tumours. Negative side of radiation is the fact that nearly 80 % of patients have acute symptoms and diarrhea. Radiotherapy induced diarrhea could be considerably minimized by consuming lyophilized mixed probiotic strains composed of four Lactobacillus strains, three Bifidobacterium strains and one Streptococcus delbrueckii subsp. thermophilus strain (Delia et al., 2007). Adversely, Giralt et al. (2008) through double blind randomised clinical study defined that probiotic drink containing Lactobacillus casei DN-114 001 in the concentration of 10^8 cfu/g does not reduce the incidence of radiation-induced diarrhea. Research was carried out on patients who were diagnosed and operated endometrial adenocarcinoma (mucous membrane of uterus). However, significant effect on stool consistency was confirmed which shows that there is still positive effect of probiotic bacteria. Similar activity in prevention of radiation-induced diarrhea was confirmed for probiotic bacteria Lactobacillus rhamnosus GG (Urbancsek et al., 2001).

Diarrhea caused by lactose intolerance

Because of the lack of the intestine enzyme β-galactosidase (lactase), some people do not have the ability to degrade lactose. Non-degraded lactose induces illness with symptoms such as convulsion, flatulence, diarrhea and nausea. After eating yoghurt or other fermented milks, lactose intolerance is considerably lower in the comparison to the reaction after eating other kinds of dairy foods. In fermented milks the concentration of lactose is much lower (30 % average), while probiotic variety of fermented milks also contains a microbial β-galactosidase (Fooks et al., 1999). Fermented milks casein, calcium-phosphate and lactate neutralized gastric acid (acting like a buffer). Therefore the microbial β-galactosidase in the active form comes to a small intestine and the symptoms of the illness absent (Pochart et al., 1989). At 80 % of lactose intolerant people, after taking 18 g of lactose by milk, diarrhea and/or flatulence will occur. However, symptoms of the illness failed when the same content of lactose was consumed along with yoghurt. Activity of β-galactosidase contained in yoghurt is enough to digest 50-100 % of consumed lactose in amount of 20 g (Miller et al., 2007).

Conclusion

The preventive and therapeutic effect of probiotic bacteria is not the same in different types of diarrhea. The main value of proven positive results in prevention and therapy of infant’s and children’s acute diarrhea as in diarrhea caused by antibiotic therapy is reduction of the treatment...
terapija
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Betica-Radić, Lj. (2000): Antibiotici i probavni trakt, Medicus 9
Bergogne-Bérézin, E. (2000): Treatment and prevention of
dijareja i dijareje kao posljedice dijareje provedenih posljednjih desetak godina. Značajan, ali nešto manji učinak probiotičkih bakterija dokazan je kod dijareje kao posljedice uzimanja antibiotika. Pozitivan učinak probiotičkih bakterija u prevenciji putničke dijareje i dijareje koja se javljaju posle terapije zračenjem nije značajan. Preventivni i terapijski učinak na dijareju neovisan je o načinu uzimanja probiotičkih bakterija, fermentiranim mljekom, kapsulom ili oralnom rehidratacijskom otopinom.

Ključne riječi: dijareja, probiotičke bakterije, prevencija, terapija

References

Probiotičke bakterije u prevenciji i terapiji dijareje

Sažetak


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