

PROBIOTIC IN THE ORAL CAVITY AND ITS ROLE

Tuti Kusumaningsih

¹ Department of Oral Biology Faculty of Dentistry, Airlangga University Surabaya Indonesia

* Corresponding Author: tutikusumaningsih@yahoo.com

ABSTRACT

Background : Probiotics as live microorganisms which when administered in adequate amounts confer a health benefit on the host. In healthy humans, there is a favorable balance between microbes and microbial pathogens. Diseases that commonly occur in the oral cavity are dental caries and periodontal disease, in which both diseases are caused due to an imbalance of both population and number of normal flora with microbial pathogens. Mechanism of action of probiotics can generally be classified as : competitive exclusion, bacterial antagonism and immune modulation. **Purpose :** The aim of this presentation was to review how the role of probiotics bacteria in the oral cavity. **Reviews:** Effect of oral administration of probiotics against dental caries has been observed in several experiments using several different strains of probiotic bacteria. It has been proven that *L.rhamnosus GG* and *L.casei* potentially inhibit the growth of oral streptococci. Yogurt products that exists in Japan one of them containing *Lactobacillus reuteri* after consumption, to reduce the number of *Streptococcus mutans* in saliva. At the time of attachment, *L.reuteri* will produce bacteriosin to inhibit the growth of *S.mutans*. **Conclusion :** Probiotics bacteria as normal flora is very suitable for use as therapy in diseases of the oral cavity.

Key words : probiotic, oral cavity, normal flora

Introduction

The last few years is a common market of dairy products and beverages containing probiotics. Perhaps there are many people who do not know what exactly are probiotics.

According to the definition of the FAO/WHO (Food and Agricultural organization/ World Health Organization) probiotics are live microorganism which when consumed in sufficient quantities, can provide health benefits to those who consume.^{1,2} Interest in probiotic health function is started from the 20th century when Russian scientist nobel laureates, Ellie Metchnikoff in 1908 the link between health and longevity of Bulgarian people with the habit of consuming fermented milk containing the microorganisms producing lactic acid bacteria.^{2,3}

Over the last ten years of research on probiotics has grown substantially in which almost all of the research aimed at finding new strains of lactic acid bacteria as potential probiotics. Species that was first introduced as probiotic bacteria are *Lactobacillus*

acidophilus and *Bifidobacterium bifidum* ⁴, and among a number of benefits were found from the two species are able to reduce susceptibility to infection, reduce allergies lactose intolerance, lowering blood pressure and lowering cholesterol in serum.³ Probiotics have been widely researched and successfully used as therapeutics in diseases in the digestive tract, but has not been much studied and discussed how they affect when used as therapy in the oral cavity. Research laboratories that isolate probiotic bacteria of 18 different milk companies in Japan reported that only strains of *Lactobacillus reuteri* ATCC 55730 is able to inhibit the growth of *Streptococcus mutans*, then proceed to examine the effect of *Lactobacillus reuteri* on the enamel, the results reported that the bacteria are not harmful to the enamel.⁵ Based on these reasons the author would like to discuss about how the role of probiotic bacteria in the oral cavity.

LITERATURE REVIEW

Ecology of microbes in the oral cavity

Approximately there are 400-500 species of bacteria in the oral cavity, where the habitat is found on the surface of the teeth, mucous membranes and crevices or between the teeth and this is an ecosystem which is kept in a state of homeostasis.⁶ Accumulates

On the surface of microbial communities through the process of colonization. For example, on the surface of the first tooth is held streptococci and *Actinomyces* colonization, over time the proportion of Gram-positive facultative anaerobic bacteria decreased and gram negative bacteria eventually become more established anaerob, especially in the interdental (gingival margin). Communities from various species of bacteria called plaque that very complex and dynamic.⁷ Population and the number of bacteria in dental plaque can be changed at any time. In addition to the oral cavity there are beneficial microbes also are opportunistic pathogenic microbes.

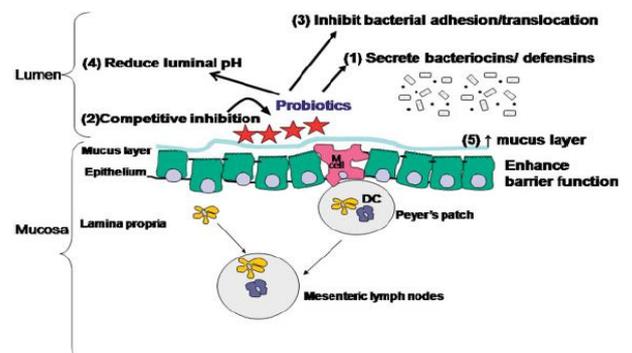
Relationship with the occurrence of microbial populations in the oral diseases.

In healthy humans, there is a favorable balance between oral flora and microbial pathogens. Diseases that commonly occur in the mouth are caries and periodontal diseases, in which both disease are caused due to an imbalance of both population and number of beneficial microbes with bacterial pathogens.⁸ In a dental caries occur an increasing number of acidogenic and aciduric bacteria like *Streptococcus mutans* and lactobacilli although other bacteria with similar properties also found as bifidobacteria, non mutans streptococci, *Actinomyces spp*, *Propionibacterium spp*, *Veillonella spp* and *Atopobium spp* that also involved as the cause of this disease.⁹ In periodontal disease, there is an increase in plaque mass and occur imbalance between anaerobic and proteolytic bacteria.

Mechanism of action of probiotics in oral cavity

In oral cavity, probiotics can create a biofilm, acting as a protective lining for oral tissues against oral diseases. Such a biofilm keeps bacterial pathogens off oral tissues by filling a space pathogens would invade in the absence of the biofilm and competing with cariogenic bacteria and periodontal pathogens growth.¹⁰ Antimicrobial actions of probiotics include the 1.production of bacteriocins/defensins,2.competitive inhibition with pathogenic bacteria3.inhibition of bacterial adherence or translocation, and4.reduction of luminal pH.Probiotic bacteria can also enhance intestinal barrier function by 5.increasing mucus production.¹¹

Figure 1. Antimicrobial action of probiotics



Probiotic bacteria

Bacteria are commonly used as probiotic bacteria is Lactic Acid bacteria (LAB), because the bacteria are able to convert sugar (including lactose) and other carbohydrates into lactic acid, that LAB also produce antimicrobial components of different such as organic acids, hydrogen peroxide, carbon peroxide, diasetil, antimicrobial agents with low molecular weight, bacteriocin and probiotic bacteria can inhibit microbial attachment pathogen.¹¹ Important properties required for oral probiotic bacteria is its ability to attach to oral cavity surfaces, such as buccal mucosa, tongue and mucosal surfaces of the teeth.

Lactobacilli estimated amount of 1% of the total oral microflora that exist. Lactobacilli species are more commonly found in saliva is *L.fermentum*, *L.rhamnosus*, *L.salivarius*, *L.casei*, *L.acidophilus* and *L.plantarum*. While the predominant species obtained in the oral cavity of healthy individuals are yaitu *L.fermentum*, *L.plantarum*, *L.salivarius* and *L.rhamnosus*.¹²

Not all species of Lactobacillus and Bifidobacterium suitable for use as probiotics. There are several recommended criteria for selecting probiotic strains.¹³ : a. Origin, preferably derived from the human digestive tract, b. Safety, should not pathogenic strain and is not sensitive to antibiotics in general and no less important has no antibiotic resistance or virulence properties of plasmids. c. Withstand host's natural barrier, resistant to the body's natural defenses such as able to survive at low pH, resistance to bile salts in which this is an early test for the selection of probiotics strain. d. Adherence to intestinal epithelium. Being able to attach to intestinal mucosa cells and effectively close the surface of the intestine of its area of attachment of pathogenic bacteria. e. Commercial propagation. Able to survive in the process of storage of food product or beverages. f. functional properties. Strains should be useful in accordance with that mentioned in the definition of probiotic.

Activity or the role of probiotic bacteria in the oral cavity

Dental caries.

Effect of oral administration of probiotic against dental caries has been observed in several experiments using several different strains of probiotic bacteria. It has been proven that *L.rhamnosus GG* and *L.casei* potentially inhibit the growth of oral streptococci.⁶ Yogurt product that exists in Japan one of them containing *Lactobacillus reuteri* can reduce the number of *Streptococcus mutans* in saliva after consumption.

Oral Candidiasis

Candidiasis is a fungal disease caused by *C.albicans*. Candida species are normal flora, which can cause infections of oral mucosa mainly occurs immunocompromised patients. A research

has shown that subjects who consumed cheese containing *L.rhamnosus GG* can reduce the prevalence of oral candida which this may affect the occurrence of oral candidiasis decreased.¹⁴

Periodontal diseases.

Research conducted by Krasse et al showed that a decrease in gingival index and the number of bacteria in plaques who were given probiotic *L.reuteri* compared with the placebo group, concluded that probiotics are effective in reducing gingivitis and plaque bacteria in patients with moderate to severe gingivitis.¹⁵ Twetman et al who used chewing gum containing *Lactobacillus reuteri* to measure its effect on the volume of liquid gum, level of cytokines (IL-1 β , IL-6, IL-10 dan TNF- α) bleeding and probing. The volume of crevicular fluid as well as the level of TNF- α and IL-8 the bleeding decreased significantly.¹⁶

Halitosis

The use of probiotics regularly can help control halitosis. *Weissella cibaria* reduced levels of volatile sulfide components produced by *Fusobacterium nucleatum*, this study conducted by Kang et al.¹⁷

Discussion

According to the WHO definition are live microorganism which when consumed in sufficient quantities will provide a host of health benefits. From these definitions it can be concluded that not all bacteria is harmful, in fact there is a beneficial to the health of the normal flora. The role of probiotics in the gastrointestinal tract is based on the ability to attach to the intestinal mucosa so that it can compete and inhibit intestinal pathogens. It was so also in the oral cavity, probiotics bacteria attach to the teeth and oral mucosa. Probiotic bacteria then compete with cariogenic bacteria and periodontal pathogens. Some literature states that the basic concept of probiotics is bacteriotherapy or replacement therapy.⁹ So in the oral cavity probiotics compete with oral pathogen in terms of finding a place to attach. Obviously because of the area or mucosa which is usually occupied by pathogenic oral bacteria have been occupied by the probiotic bacteria and then oral pathogenic bacteria can not attach to its receptor. With this concept of *Lactobacillus reuteri* can improve oral health is by

THE SECOND INTERNATIONAL JOINT SYMPOSIUM ON ORAL AND DENTAL SCIENCES
Featuring: Next Generation of Regenerative Therapy in Dentistry
Yogyakarta, March 1 – 3, 2012

killing the bacteria *Streptococcus mutans*, which is the main cause of dental caries.¹¹ Halitosis or mal odor is a condition that can occur due to an interruption of oral commensal microflora balance. This situation can be eliminated by administering probiotic regularly. A study by Kang et al 2006 showed that the production of Volatile Sulfur Compound (VSC) produced by *F.nucleatum* can be inhibited after consuming a probiotic containing *Weissella cibaria* both vitro and invivo. In children the reduction of H₂S and CH₃SH could reach 48% to 59.4% H₂S CH₃SH where as this state occurs after rinsing with a solution containing *Weissella cibaria*.

Conclusion

Dental caries and periodontal disease is an infectious disease most often found in the oral cavity. Both of these infectious diseases is due to the imbalance between the number and proportion of normal flora by bacterial pathogens, in other words there is a change in the ecology of the oral cavity. Probiotic bacteria as normal flora is very suitable for use as therapy with the concept of whole bacteria replacement therapy to eliminate bacterial pathogen

DAFTAR PUSTAKA

1. Anonim, Food and Nutrition : Probiotics, Available from : http://www.answers.com/topic/probiotics?ca_t=health Accessed: 16-4-2008
2. Nuraida L, The Latest Up Date on Probiotics, Food Review Indonesia, 2009, 1 – 4
3. Twetman S & Steckslen-Blicks C, Probiotics and oral health effects in children, Inter J of Paediatric Dentistry, 2008,18 : 3 – 10
4. Probiotics, diakses dari <http://en.wikipedia.org/wiki/Probiotics>, tanggal 25 - 02-2008
5. Nikawa H, Makihira S, Fukushima H, Nishimura H, Ozaki Y, Ishida K, Darmawan, Hamada T, Hara K, Matsumoto A, Takemoto T, Aimi R, *Lactobacillus reuteri* in fermented bovine milk decreases the oral carriage of mutans streptococci, 2004, Int J Food Microbiol 95 : 219-223
6. Simon L, The Role of *Streptococcus mutans* And Oral Ecologi in The Formation of Dental Caries, 2007, 2 : 1-12
7. Lamont RJ, Burne R A, Lantz M S, Leblanc D J, The Oral Environment. Dalam Oral Microbiology and Immunology, American Society for Microbiology Press, 2006 : 47 – 72
8. Scheie A.A, The Biofilm Concept : Consequences For Future Prophylaxis of Oral Disease? in Crit Rev Oral Biol Med, 2004, 15 (1) : 4-12
9. Devine D A and Marsh P, Prospects for the development of probiotics and prebiotics for oral applications, J of Oral Microbiology, 2009;1:1 – 10
10. Fernandez AJF, Domingo TA, Oltra DP, Diago MP. Probiotic treatment in the oral cavity: An update. Med Oral Patol Cir Buccal. 2010, Sept 1;15,(5): 677-80
11. Hart AL, Kamm MA, Stagg AJ and Knight SC, (2009), vol.15((2):300-309
12. Meurman J.H, Probiotics: do they have role in oral medicine and dentistry?, Eur J Oral Sci, 2005, Jun;113(3): 188-196
13. Meurman J H, Stamatova I, Probiotics : contributions to oral health, Oral Diseases, 2007, 13 : 443 – 451
14. Darwazeh A .Probiotics and Oral Disease An Update. Smile Dental Journal 2011; vol 6, issue1: 6-8
15. Krasse P, Caresson B, Dahl C, Paulson A, Nilsson A, Sinkiewicz G. Decreased gum bleeding and reduced gingivitis by probiotic *Lactobacillus reuteri*. Swed Dent J. 2006;30 : 55-60
16. Twetman S, Derawi B, Keller m, Ekstrand K, Yucel –Lindberg, Steckslen Blinks C. Short-term effect of chewing gums Containing probiotic *Lactobacillus reuteri* on the level of in-flamatory mediators in gingival crevicular fluid. Acta Odontol Scand. 2009;67: 19-24.
17. Kang MS, Kim BG, Chung J, Lee HC, Oh JS. Inhibitory effect of *Weissella cibaria*

THE SECOND INTERNATIONAL JOINT SYMPOSIUM ON ORAL AND DENTAL SCIENCES
Featuring: Next Generation of Regenerative Therapy in Dentistry
Yogyakarta, March 1 – 3, 2012

isolate On the production of volatile sulphur
compound. J Clin Periodontol.2006;33 :226 -
32