Probiotics for Control of Nosocomial Infections

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ABSTRACT

Probiotics are usually defined as live microbial food ingredients beneficial to health which comprise of normal commensally bacteria as a part of the healthy human gut microflora. Different species of microorganisms such as lactic acid bacteria (*Bifidobacterium*and *Lactobacillus*spp.) or yeasts have been proposed for human use.Nosocomial infections occur worldwide and affect both developed and poor countries.The most common organisms causing nosocomialinfection in neonates include *Staphylococcus*, *Pseudomonas aeruginosa,Escherichiacoli*,*Klebsiella*, and *Candida*.There is preliminary evidence that probiotic type microorganisms may control the growth of nosocomial pathogens.The aim of this review is to consider the current evidence on the effects of probiotics for control of nosocomial infections.

Key words: Probiotics,nosocomial infections,safety,Infection control.

INTRODUCTION

Probiotics can be defined as nonpathogenic microorganisms that, when ingested, exert a positive influence on the health of the host. They consist of either yeast or bacteria, especially lactic acid bacteria. The most commonly used organisms in probiotic products belongs to *Lactobacillus* and *Bifidobacterium* spp., Other organisms have also been used including *Bacillus* spp., and yeast such as *Saccharomyce boulardii* (Darsanaki and Aliabadi, 2013). In Table 1 are listed some of the known probiotics available (Mombelli and Gismondo, 2000).

Probiotics can produce inhibitory compounds such as lactic acid, bacteriocin, hydrogen peroxide, acetaldehyde anddiacetyl. These compounds are able to inhibit the growth of pathogenic microorganisms (Zapata, 2013). Probiotics could be used for several conditions such as Urinary Tract Infections, Irritable Bowel Syndrome, Immune Disorders, Lactose Intolerance, Hyper Cholesterolaemia, Inflammatory Bowel Disease,Cancer, Allergy andDiarrhea (Zerehpoosh and darsanaki, 2013). Nosocomial infections occur worldwide and affect both poor and developed countries. Infections acquired in health care settings are among the major causes of death and increased morbidity among hospitalized patients. They are a significant burden both for the patient and for public health (WHO, 2002). Over the past 50 years, the epidemiology of pathogens responsible for nosocomial infections in neonates has changed dramatically. During the 1950s, *Staphylococcusaureus* was the most common nosocomial pathogen in hospitalized infants. During the 1960s, gram-negative bacilli, including *Pseudomonas aeruginosa*, *Klebsiella* sp, and *Escherichia coli*, became the most common pathogens. By the 1970s, coagulasenegative *staphylococci* (CONS) (*S. epidermidis*) and *S. aureus*, including methicillinresistant *S. aureus* (MRSA), became the predominant causes of hospital-acquired infections in the neonatal intensive care unit. Today, gram-positive cocci continue to cause the largest proportion of infections, and many, including CONS,MRSA, and vancomycin-resistant enterococci(VRE), are multidrug-resistant. Gram-negative bacilli are responsible for 20% to 30% of cases of lateonset sepsis and 30% of nosocomial pneumonias (Table. 2) (Polin and Saiman, 2003).

There is preliminary evidence that probiotic type microorganisms may control the growth of nosocomial pathogens (Falagas and Makris, 2009).The aim of this review is to consider the current evidence on the effects of probiotics for control of nosocomial infections.

Control of Nosocomial Infections by Probiotics

Due to concerns regarding development of antibiotic resistance in hospitals, rising healthcare costs and lack of new antimicrobial classes being developed, probiotics have been considered a good prophylactic or therapeutic alternative in numerous conditions. Probiotics do not have the risk of antimicrobial resistance and offer practical benefits like low-cost preparation, long shelf life, and ease of administration (Oudhuis *et al*, 2011) .We identified 29studies involving in-vitro experiments on the potential role of probiotics in the inhibition of nosocomial pathogens (bacterial or fungal) (Table 3).

CONCLUSION

However, there are still many questions to be answered before probiotics can be used routinely as therapy. At presence, with increasing of the antibiotic resistance and side effects of chemical drugs, it seems, we need to use alternative remedies. Probiotics can have therapeutic application in future.

Table 1: Common probiotics for human use

***Lactobacillus* species**	***Bifidobacterium* species**	**Other bacteria**	**Non-lactic acid producing bacteria**
L. acidophilus	*B. lactis*	*L. lactis*	*S. cerevisiae*
L. casei	*B. animalis*	*E. faecium*	*B. subtilis*
L. crispatus	*B. bifidum*	*E. faecalis*	*S. boulardii*
L. gasseri	*B. infantis*	*P. acidilactici*	*B. cereus*
L. johnsonii	*B. adolescentis*	-	-
L. reuteri	-	-	-
L. rhamnosus	-	-	-

Table 2: Common Nosocomial Infections

Common Pathogens	**Less Common Pathogens**	**Site of Infection**
Pseudomonas aeruginosaStaphylococcus aureusCandida sp.Coagulase negative staphylococci	*EnterococciKlebsiella* sp. *Serratia marcescens Enterobacter* sp.*Malassezia* sp.	Bloodstream/sepsis
Gram-negative bacilli*Enterococci*	*Candida* sp.	Urinary tract
*S. aureus*Coagulase negative staphylococci	*Enterococci*S.*marcescens Aspergillus* sp.	Skin/soft tissue/ surgical site
*S. aureusP. aeruginosa*Coagulase negative staphylococciRespiratory syncytial virus	*EnterococciKlebsiella* sp. *S. marcescens*	Pneumonia
*S. aureus*Coagulase negative staphylococci	*Candida* sp.	Endocarditis
Coagulase negative staphylococci*S. aureus*	*S.marcescensEnterobacter* sp. *Candida* sp.	Central nervous system

Table 3: In-vitro studies regarding the effect of probioticsin the inhibition of nosocomial pathogens

Probiotic used	Isolated from	Nosocomial pathogens	Region	Reference
L. plantarum, *L. delbruekii*, *L. acidophilus*,' *L. brevis*, *L. casei*	Sausages	*S. aureus*	Iran	Nowroozi et al., 2004
Lactobacillus and. *Bifidobacterium* spp	Probiotic Milk	*S. aureus* ATCC 25922*S . pneumoniae* ATCC 41619	USA	Rosario et al., 2005
L. casei L. bulgaricus	Various Foods	*P.aeroginosa, S. aureus KlebsiellaEnterobacter*	Turkey	Erdourul and Erbulur, 2006
L. plantarumL. casei subsp. ParacaseiL. casei	Standard	*P. aeruginosaS. aureus*	Romania	Iordache etal., 2008
Lactobacillus spp.	YogurtCheese	*S. aureus* MRSA *P. aeruginosaE. coli*	Bulgaria	Petrova etal.,2009
L. acidophilusB. animalis L. paracasei subsp. *paracaseiPropionibacterium freudenreichii* sub' sp.*shermanii*	Satandard	*S. aureusE. coli*	Australia	Tharmaraj and shah, 2009
L. *acidophilusB. bifidum*	Probiotic Tablet	*S. aureus* PTCC 1431*P. aeruginosa* ATCC 27853*E. coli* PTCC 1399	Iran	Darsanaki et al., 2011
L. lactisL. delbrecukii	Traditional Dairy Product	*S. aureusE. coli*	Sudan	Salih et al., 2011
Lactobacillus, . *Streptococcus* and *Bifidobacterium* spp	Yoghurt	*S. aureus, E. coli,P. aeruginosa*.	Iran	Hami et al., 2011
L. bulgaricus	Yoghurt	*E. coli*ATCC 10536 S. aureus ATCC 6538	Pakistan	Maria etal, 2011
Lactobacillus spp.	Traditional Dairy Products	*E.coli* PTCC1399	Iran	Jafari etal, 2011
Lactobacillus,	Cabbage, Milk,	*E. coliS. aureus*	United	Tejero etal., 2012

Bifidobacterium, *Lactococcus* and *Streptococcus*	Cheeseand Human origin		Kingdom	
L. PlantarumL. caseiL. brevis	Fresh Vegetables	*S. aureus* PTCC 1431 *E. coli* PTCC 1399	Iran	Darsanaki et al., 2012
*Lactobacillus*and *Streptococcus* spp.	Fermented Toddy	*EnterobacterE.coli Klebsiella sp.S. aureus*	India	Krishnamoorthy and Arjun, 2012
L. acidophilus L. caseiL. brevis	Traditional Yoghurt	*E. coli* PTCC1399 *S. aureus* PTCC 1431	Iran	Issazadeh1 et al., 2013
Lactobacillus and *Bifidobacterium*spp.	CheesesYoghurt, MilkKishk	*S. aureusE. coli*	Egypt	Ali etal., 2013
Lactobacillus, *Bifidobacterium* and *Propionibacterium* sp.	Sourdough, Vegetables, Yoghurt, Cheese andHuman origin	*E. coli* ATCC 25922*E. coli* ATCC 8739*S. aureus* ATCC 25093 *P. aeruginosa* ATCC 9027 *S. aureus* ATCC 6538Aspergillus	Bulgaria	Denkova et al., 2013
L. acidophilus L. bulgaricus, L. casei, *L. plantarum*	Traditional Yoghurt	*P. aeruginosa, S. aureus* (MRSA)	Iraq	Ahmed, 2013
Lactobacillus spp.	YoghurtMilk	*E. coliS. aureus*	Saudi Arabia	Abdallah etal., 2013
L. fermentum L. rhamnosusL. plantarum' L. caseiL. delbrueckii subspp.*bulgaricus*	Standard	P. aeruginosa, S. aureus	India	Srinu et al., 2013
L. bulgaricusS. thermophilesL. lactis	Dairy products	*EnterococcusS. epidermitidis*	Algeria	Mezaini and Bouras, 2013
L. plantarum	Grass silage	*E. coli*	India	Prema, 2013
L. sakei subsp *sakei* PTCC 1712*L. casei* subsp *casei* PTCC 1608 *L. plantarum* subsp *plantarum* PTCC1745'	Standard	*S. aureus* Clinical*S. aureus* PTCC 1431*E. coli* Clinical *E. coli* PTCC 1399	Iran	Chakoosari et al, 2014

L. lactis subsp *lactis* PTCC 1336				
L. acidophilus *L. PlantarumL. casei'* *L. delbrueckii* sub sp. *bulgaricus*	Commercial Yoghurt	*E. coli* PTCC1399 *S. aureus* PTCC 1431	Iran	Tajehmiri et al., 2014
L. plantarum *L. rhamnosusL. casei* *L. acidophilusL. brevis*	Traditional Yogurt	*E. coli* PTCC1399 *S. aureus* PTCC 1431	Iran	Nasiri Moslem et al., 2014
Lactobacillus ssp.	Standard	*S. aureus* MTCC1144 *E. coli* 0157:H7	India	Vij etal., 2014
Bifidobacterium. *Lactobacillus* Spp	Commercial probiotic strains	*P. aeroginosa* PTCC 1707*S. aureus* PTCC 1431*Enterococci*	Iran	Darabi etal., 2014
Lactobacillus spp.	Fermented Rice	*Candida* spp.*E. coli* ATC 259222	Srilanka	Jeygowri etal., 2014
Lactobacillus spp.	Human origin	*S. epidermidis* ATCC 12228*E. coli* ATCC 29181*S. aureus*	Malaysia	Shokryazdan etal., 2014

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