Assessment of the effect of different Probiotic strains on Oral Health conditions: An In Vivo and In Vitro study.

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وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ

وَكَانَ فَضْلُ اللَّهِ عَلَيْكَ

عَظِيمًا

Dedication

To my father and mother who are always there for me, giving me the strength to carry on, without their help this work would have never been accomplished.

To my brother and sister for their encouragement.

And last but not least to my beloved daughter Sophie.

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List of Abbreviations

Abb.	Full term
S. mutans	Streptococcus mutans
ECC	Early childhood caries
Dmft	d= decayed primary tooth m= missing primary tooth f= filled primary tooth t= tooth
ART	Atraumatic Restorative Treatment
FAO	The Food Agricultural Organization
WHO	World Health Organization
IBD	inflammatory bowel disease
PI	Plaque Index
GI	Gingival Index
MSB	Mitis Salivarius Bacitracin agar
cfu/ml	colony forming units per ml
B.	Bifidobacterium
L.	Lactobacillus
S.	Streptococcus

Introduction

Dental caries and periodontal disease are the two universal diseases of the teeth and their supporting tissues[(1)]. These diseases are conditional; critical number of factors must be present for these diseases to occur.[(2)]

Caries and periodontal disease are initiated by deposition of bacterial dental plaque on teeth. Bacterial plaque may be considered to have three functional components: - Cariogenic organisms, of which Streptococcus mutans (S. mutans), Lactobacilli and Actinomyces are the most important. - Organisms inducing gingivitis and periodontitis, such as Veillonella, Fusobacteria, Bacteroides and Actinomyces. - Adjuvant and tolerizing agents, the most potent of these are lipopolysaccharides, dextrans and levans. The interaction of bacteria with the adjuvant and tolerizing agents in plaque may induce immune responses which could enhance or inhibit the development of caries and periodontal disease. [(1)]

Dental disease is widely recognized as infectious disease, children are specifically at risk of developing dental caries since the host defense systems are in the process of being developed, tooth surfaces are newly erupted and may be showing hypoplastic defects and they are experiencing the dietary transition between breast/bottle feeding and solid foods. In preschool children the intensity of caries is due to frequent sugar consumption.[(3)]

Evidence suggests that children are most likely to develop caries if S. mutans is acquired at early age, although this may be partly compensated by other factor as good oral hygiene and non-cariogenic diet. [(3)]

Microbial colonization is known to begin at birth; a young child without any teeth usually doesn't carry any S. mutans. Colonization of the oral cavity with S. mutans in children is generally the result of transmission of the organism from the child's primary caregiver, usually the mother due to the close maternal– child contact and sharing of food and utensils. (4)

Probiotics are live microorganisms which when administered in adequate amounts, confer a health benefit on the host.(5) Probiotics have been successfully used to control gastrointestinal diseases, to alleviate symptoms of allergy, and in diseases with immunological pathology. (6)

However, the currently available information on oral probiotic uses such as therapy for oral cavity disorders including tooth decay or periodontal disease is scarce.

Review of Literature

Caries

Caries in Latin means ‘rotten’, for a non-professional caries meant a hole in the tooth and for the dental professionals it meant destruction of the tooth structure in the form of cavitation. Past definitions of dental caries always projected it as a progressive demineralization resulting in the destruction of the tooth structure. Even the latest definitions in certain textbooks mention dental caries as an irreversible disease. However, Ernest Newbrun stated that caries is not just a continuous and unidirectional process of the demineralization of the mineral phase, but seems to be cyclic, with periods of demineralization immediately following metabolism of a fermentable substrate by the plaque flora, interspersed with periods of remineralization.[7]

Early childhood caries (ECC) is defined as the presence of tooth decay that involves any primary tooth in a child younger than 6 years.[8] Also referred to as early childhood tooth decay (and formerly called baby-bottle tooth decay), the term ECC better reflects that the disease process is much more complex and involves transmission of infectious bacteria, dietary habits, and oral hygiene. ECC has been termed the most prevalent pediatric infectious disease and the most common chronic disease of children. [9]

Despite great improvements in the oral health of populations in several countries, global problems still persist. This is particularly among underprivileged groups in both developing and developed countries. Poor oral health may have a profound effect on general health, and several oral

diseases are related to chronic diseases (e.g. Diabetes). The experience of pain, problems with eating, chewing, smiling and communication due to missing, discolored or damaged teeth have a major impact on people's daily lives and well-being. Furthermore, oral diseases restrict activities at school, at work and at home causing millions of school and work hours to be lost each year throughout the world. [(7)]

Dental caries is still a major health problem in most industrialized countries as it affects 60–90% of school-aged children and the vast majority of adults. Dental caries experience in children is relatively high in the Americas (dmft = 3.0) and in the European Region (dmft = 2.6) whereas the index is lower in most African countries (dmft = 1.7). In most developing countries, the levels of dental caries were low until recent years but prevalence rates of dental caries and dental caries experience are now tending to increase. This is largely due to the increasing consumption of sugars and inadequate exposure to fluorides. [(7)]

The primary etiologic factor for caries is Mutans Streptococci (Streptococcus mutans and Streptococcus sobrinus) in addition to Lactobacillus species, Streptococcus sangius, Streptococcus gordoni and Streptococcus oralis.[(2)]

Caries is initiated by the deposition of bacterial plaque on the teeth. Dental plaque is a complex permanent bacterial community, formed through a dynamic process where the indigenous plaque microbiota adheres to the salivary pellicle with a very rapid doubling time. Bacterial cell division plays the predominant role in achieving the bacterial numbers observed in dental plaque after 4 – 8 hours. Successful colonization of pioneer bacteria on surfaces is due to: - The strain's ability to compete with other strains to