

# Evaluation of the efficacy of probiotics in plaque reduction and gingival health maintenance among school children – A Randomized Control Trial.

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## ABSTRACT

**Background:** Probiotics are live micro-organisms that when administered in adequate amounts confer health benefits upon the host. The impact of probiotics on oral health is relatively new with lots of research going on; the area of probiotics and periodontal disease is still in its infancy. The aim of the present trial was to evaluate the efficacy of the probiotics in plaque reduction among school children.

**Materials & Methods:** This is a randomized, double-blind, placebo controlled parallel design study involving 216 school children (aged 14 - 17 years): 108 as experimental subjects and 108 as controls. Complete oral prophylaxes were performed for both the control group and experimental group. The pre-intervention plaque index and gingival index were recorded one week after the prophylaxis for both groups as the baseline data. The study subjects (Group A) included curd in their daily diet for 30 days, while the control subjects (Group B) excluded curd in their diet for 30 days. The post intervention plaque index and gingival index were recorded again and statistically compared with the baseline data.

**Results:** the intervention group (Group A) was found to have statistically significant reduction in plaque when compared to that of the control group with  $p < 0.001$  and there was no significant improvement in gingival health.

**Conclusion:** A short-term daily ingestion of probiotics delivered via curd in diet reduced the levels of plaque. Hence if it can be promoted in the regular diet, it would help in improving the oral health among school children.

**Key Words:** Gingivitis, Probiotics, Plaque.

**How to cite this article:** Karuppaiah RM, Shankar S, Raj SK, Ramesh K, Prakash R, Kruthika M. Evaluation of the efficacy of probiotics in plaque reduction and gingival health maintenance among school children – A Randomized Control Trial. *J Int Oral Health* 2013; 5(5):33-7.

**Source of Support:** Nil

**Conflict of Interest:** None Declared

Received: 15<sup>th</sup> June 2013

Reviewed: 18<sup>th</sup> July 2013

Accepted: 8<sup>th</sup> August 2013

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## Introduction

Health is a priceless positive facet of life hence maintenance of health is of utmost importance for a productive life. Oral health is an integral part of general health which can be achieved by good oral

hygiene. Oral hygiene maintenance is directly related to the control of plaque in the oral cavity. There are different methods of plaque control among which mechanical plaque control plays a major role with chemical method as an adjunct to it.<sup>1</sup> Chemical plaque

control includes antibiotics, enzymes, bisguanides, metallic salts, etc. Though these methods have been proved effective, they lack the prevention of further microbial colonization, and their continued and prolonged use causes more harm than good. These shortcomings paved the way to the development of a gentle yet efficient plaque control agent.

Lactobacilli play an important role in the maintenance of health by stimulating the natural immunity as well as by contributing to the balance of the microflora, by interacting with the other members of the flora. The application of health-promoting bacteria for therapeutic purposes, is one of the strongest emerging fields. Time has come to shift the paradigm of the treatment from specific bacteria elimination to alteration of the bacterial ecology by using probiotics.<sup>2</sup> The word probiotic is derived from the Greek word meaning "for life". The concept of probiotics dates back to 1908, when Noble Prize winner Eli Metchnikoff suggested that the long life of Bulgarian peasants resulted from their consumption of fermented milk products.<sup>3</sup> The Food and Agriculture Organization (FAO) and World Health Organization (WHO) defined probiotics as 'Live microorganisms which when administered in adequate amounts confer a health benefit on the host' (FAO/WHO, 2001).<sup>4</sup> There has been a rapid development in the understanding and use of such microorganisms in human conditions and diseases. Currently well-established probiotic effects are prevention and reduction of virus- induced or antibiotic-associated diarrhoea, reduction of the concentration of cancer-promoting enzymes, prevention and alleviation of unspecific and irregular complaints of the gastrointestinal tracts, beneficial effects of inflammation and other complaints in connection with diseases of the gastrointestinal tract, prevention of allergies and atopic diseases in infants and prevention of respiratory tract infections (common cold, influenza) and other infectious diseases. Since the oral cavity is a confined compartment within the human body i.e. anatomically, the oral cavity is connected to the nasopharynx, the larynx, the tonsils, the middle ear through the Eustachian tube and the gastrointestinal tract. Physiologically it is connected to the whole body and by this, the oral cavity is influenced by and influences

general health. The oral microbiota which is as complex as the gastro-intestinal or vaginal microbiota are considered to be difficult therapeutic targets.<sup>5</sup> These encouraging effects of probiotics in different fields of healthcare have resulted recently in the introduction of probiotics for oral healthcare. Probiotics have been clinically proved effective in different fields of oral healthcare such as: halitosis, oral candidiasis and tooth decay.<sup>6</sup>

Probiotics have also been inducted in the field of periodontal healthcare because of the current views on the etiology of plaque-related periodontal inflammation. This etiological view considers three factors that determine whether disease will develop in a subject: a susceptible host, the presence of pathogenic species and the reduction or absence of the so-called "beneficial bacteria". The third etiological factor- the reduction or absence of the "beneficial bacteria" such as probiotic bacteria present in curd and fermented milk products. Which constitute the most important source of probiotics for humans. Among these are certain lactic acid bacteria (LAB) which have had a long history of consumption by humans, either as probiotics or in traditional foods.<sup>7</sup> Such bacteria are Generally Regarded As Safe (GRAS) because they can reside in the human body causing no harm and, on the other hand, they are the key microorganisms in milk fermentation and food preservation. The most common lactic acid bacterium in curd has been used in the present study which evaluated clinically the efficacy of probiotics in plaque reduction among dental under graduates.

## Materials & Methods

### Study Group

The study group comprised of 208 healthy school children aged 14 to 17 years. Subjects with a history of systemic antibiotic or topical fluoride treatments within the 4 weeks prior to baseline, hereditary lactose intolerance were not included. The subjects had good oral health which included no active carious lesions or signs periodontal disease.

### Ethical Issues

The study subjects gave a written informed consent before the start of the intervention. The study protocol was approved by the institutional ethical committee.

### Study Design

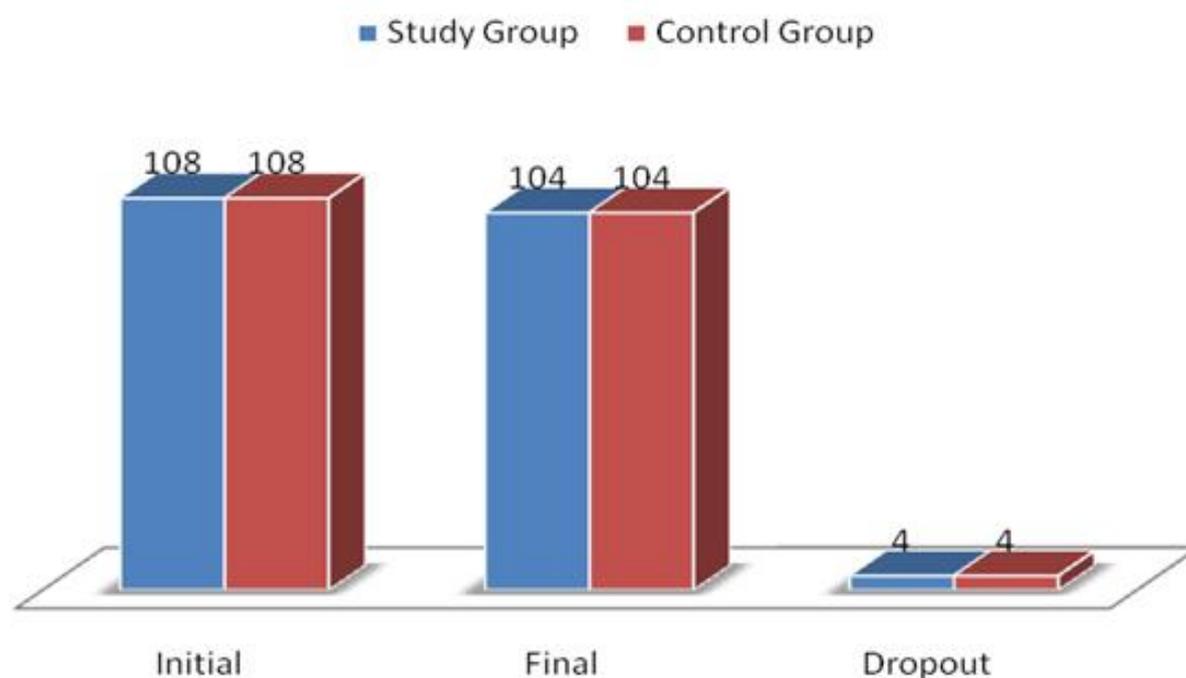
The prospective investigation was a randomized placebo-controlled study design with an experimental period of 4 weeks. All the 208 participants were provided with complete oral prophylaxis one week prior to the first intervention. The subjects were randomly assigned to two equally sized groups (n=104), Group A (probiotic group) included curd with their daily diet; group B (control group) excluded curd from their daily diet.

Gingival index and plaque index were recorded as baseline data at day 1 of the 30days study period. The

in their own method of brushing. At the end of the study period i.e. on day 30 both plaque and gingival index were recorded as a post intervention data. The data obtained were entered in excel spread sheet 2007 and subjected to statistical analysis.

### Statistical Methods

The data analysed using the Statistical Package for Social Sciences (SPSS) version 17.0. Both descriptive and inferential statistics were done. Inferential statistics included Student's 't' test was used to compare both index value between and within groups.



**Fig. 1:** Showing the distribution of the study subjects into different groups and the number of drop outs during the course of the study

gingival index recorded was Gingival Index developed by Loe H and Sillness P in 1963<sup>8</sup>, solely for the purpose of assessing severity of gingivitis and its location in four possible areas by examining only the qualitative changes (i.e. severity of the lesion). The plaque index recorded was Turesky – Gilmore – Glickman Modification of the Quigley Hein Plaque Index in 1970<sup>8</sup> in which plaque is assessed on the labial/buccal and lingual surfaces of all the teeth using a disclosing agent only in gingival third.

During the experimental period, the subjects were encouraged to maintain their normal oral hygiene habits and to continue to brush their teeth twice a day

### Results

Out of 216 subjects examined 108 were in Group A taking curd and 108 were in Group B i.e., control. At the end of the study there were 8 dropouts totally, 3 subjects in each group for the reason unrelated to the study. (**Figure 1**)

The pre- and post-intervention mean score of both probiotic and placebo group are shown in Tables 1 and 2. All subjects had high and similar scores in gingival and plaque indices at baseline. After the test period with the probiotic diet supplement in use, probiotic group subjects exhibited decreased scores for plaque index, while one subject had unchanged scores and all

subjects exhibited decreased scores in gingival index. The mean value of the gingival index scores for probiotic group was 0.42 and that of control group was 0.13 showing a significant reduction of 0.29 mean differences in gingival status and it was not statistically significant with  $P=0.132$ . (Table 1)

The mean value of the plaque index scores for

oorganisms responsible for periodontal destruction.<sup>11</sup> Probiotic microorganisms do not act exclusively by affecting the microbiota, but also protect the oral cavity through the promotion of a beneficial host response. They exert effects either by modulating immunological parameters, epithelial permeability and bacterial translocation, or by providing bioactive or

**Table 1: Comparison of reduction in Gingival index score between study and control group**

	Pre-Intervention	Post-intervention	Mean difference	Student 't' Test value	P value
Probiotic Group	2.64	2.22	0.42	1.435	0.132 <sup>NS</sup>
Control group	2.92	2.79	0.13	0.436	

<sup>NS</sup> - Not significant

**Table 2: Comparison of reduction in Plaque index score between study and control group**

	Pre-Intervention	Post-intervention	Mean difference	Student 't' Test value	P value
Probiotic Group	4.74	3.22	1.52	2.373	0.002 <sup>**</sup>
Control group	4.72	4.09	0.61	0.749	

<sup>\*\*</sup> - Highly significant

probiotic group was 1.52 and that of control group was 0.61 showing a significant reduction of 0.91 mean differences in plaque accumulation and was found statistically significant with  $P<0.05$ . (Table 2)

## Discussion

Probiotic may affect the oral ecology by specifically preventing the adherence of other bacteria and by modifying the protein composition of salivary pellicle. Probiotic bacteria could modify the protein composition of the pellicle by two different methods, namely binding to and the degradation of salivary proteins.<sup>9</sup> Probiotic lower the pH so that microorganism cannot form dental plaque and calculus that causes oral inflammation. Polonskaya first described the phenomena that probiotic such as *Lactobacilli acidophilus* strains may inhibit the invitro growth of other bacteria.<sup>10</sup>

*Fusiform nucleatum* has been regarded as a chain microorganism in dental plaque formation, possessing the ability to coaggregate with the majority of other bacteria in the oral cavity. *Lactobacilli* coaggregate with *F. nucleatum* at nearly 90%, thus modulating composition of oral biofilms.<sup>2</sup> *Lactobacilli* had been shown to be the strongest inhibitor of *A. Actinimycetemcomitans*, *P. gingivalis* and *P. intermedia*, potent micr-

regulatory metabolites.<sup>12</sup> The latter effects are appealing for periodontal health care because current evidence shows that the destruction of the periodontium is substantially mediated by the host and driven by the bacterial challenge.<sup>13</sup>

The aim of the present trial was to evaluate the efficacy of the probiotics in plaque reduction among school children. It should be noted that in one of the papers reporting on the effects of a probiotic treatment on healthy or gingivitis patients, the probiotics were administered as an adjunct to conventional plaque removal.<sup>14</sup> To our knowledge, the present study is the first to examine the oral effects of probiotics through the most common dairy product i.e. curd as probiotic vehicle.

The results were mainly in agreement with previous findings.<sup>15-17</sup> The explanation for the findings, and the mechanism of action, is not fully clear, however, it is relatively plausible that probiotics may inhibit plaque accumulation and maintain good oral hygiene by microbial replacement, because of the direct contact with the oral tissues and biofilm. From the existing literature, it is questionable whether probiotic bacteria can colonize on a permanent basis in the mouth and whether or not they have any residual effect after discontinuation of intake.

Therefore, a marked reduction of plaque and gingival indices overtime would theoretically imply a reduced risk of gingival disease, but this must of course be verified in prospective clinical trials. The clinical significance of our findings is still unclear and any premature conclusion should be avoided at this stage. Nevertheless, the present observations merit further study in order to evaluate the possible effects of probiotics on oral ecology.

### Conclusion

Within the limitation like short period of the study trial the results of this study indicate that a short-term daily ingestion of probiotics delivered via curd in diet, reduced the levels of plaque. Hence if it is promoted in the regular diet it would help in improving the oral health. With an increasing global problem of antibiotic resistance, contributing to ineffective treatment of microbial diseases, probiotics by virtue of the natural therapy appear to be a novel approach for prevention of gingival diseases. Dietary supplementation of probiotics might be used as a suitable, easy and safe method for maintaining gingival health.

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