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Commentary

Traditional food & modern lifestyle: Impact of probiotics

The name probiotic is derived from the Greek phrase 'pro bios' which means 'for life'. It was traditionally associated with fermented foods derived from dairy products, vegetables and fruits. The practice of consuming fermented foods has prevailed across civilizations and strata of societies over centuries, one can, therefore, safely assume that there is an obvious tangible benefit to the consumers of such products. As we now understand, the virtues of these foods are attributed to the probiotic organisms associated with them. The organisms that are best studied and generally regarded as probiotics are species of the bacteria *Bifidobacterium*, *Lactobacillus,* and *Streptococcus,* and also including yeast such as *Saccharomyces boulardii*[1,2]. While knowledge about the beneficial effects of the probiotic organisms and the foods that harbour them was in existence for quite some time, the interest in probiotics has increased recently with the pressing need to find alternative treatment regimens for various ailments and conditions that afflict humans. The increased awareness about lifestyle related diseases has also been one of the reasons for the interest in probiotics and probiotic based food supplementation.

Over the years, the significant role that microbes play in the intestinal ecosystem and thereby have a bearing on the health and well being of the host was well established through animal studies as well as observations made in case of human studies. Reports of fermented foods such as Kefir (Russia), Calpis (Japan), Tofu (Southeast Asia), Kimchi (Korea), Kaymak (Turkey) which are used for health benefits, characteristic of various societies have existed in the literature[3]. However, the first formal recognition of probiotic organisms was made by Metchnikoff in the early 1900s[4]. Metchnikoff attributed the exceptional long life of Bulgarian peasants to their consumption of large quantities of 'sour milk' containing *Lactobacillus bulgaricus.* He concluded that the beneficial effect was due to the ability of probiotics to replace the harmful organisms that are found in the gut. The credit however, for translating the use of probiotic organisms commercially for health benefits goes to the Japanese scientist Shirota who in 1930 had isolated and used *L. casei* for developing the widely consumed probiotic product that goes by the name of 'yakult'[5]. Currently however, there are numerous products of various origins and forms containing different organisms available in the market.

Lilly and Stilwell in 1965[6] were the first to use the term 'probiotics' to define substances secreted by one organism that stimulates the growth of another. This was further modified over the years to keep in tune with the existing knowledge of probiotics at a given time, such as the use of live organisms, the ability of the organisms to confer a health benefit, *etc*. The definition that is now widely accepted is the one given by the WHO in the year 2001 which defines probiotics as "live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host"[7].

With the recent upsurge in interest in probiotics and the development of newer techniques, the study of gut microbiota and microbiome and their relevance to human health has been possible and elegantly carried out by various groups. In a recent report by Lin *et al*[8], a comparison of the gut microbiota between healthy children of rural Bangladesh and urban children from the US regardless of their dietary habits was carried out. Using a culture independent approach by analyzing 16S rRNA sequences, the intra-individual and inter personal variations in the faecal microbial communities representing the distal gut of these subjects were studied. It was found that the microbiota from Bangladeshi children was more diverse compared

to that of the children from US and that the composition was very different in these two groups. While the Bangladeshi children showed a predominance of Firmicutes (60%) followed by Bacteroidetes (20%) and others including Proteobacteria and Tenericutes, the profile for the American children was totally different. In the American group, the levels of Firmicutes (46%) and Bacteroidetes (43%) were almost similar, followed by Proteobacteria and Tenericutes. Differences were also found within the phyla, *e.g*. genus *Prevotella* from Bacteroidetes was more prevalent than *Bacteroides* in Bangladeshi children compared to the prevalence of *Bacteroides* in children from the US[8].

An apparently similar scenario was evident from studies on children from Burkina Faso and Italy, where it was seen that *Prevotella* predominated in children associated with a plant based diet while *Bacteroides* was associated with a diet rich in animal protein and saturated fat. This study was carried out by De Filippo *et al*[9] to address the possibility that diet might influence the gut microbiota. Using an elaborate metagenomic approach, children from two different populations and having different dietary habits were studied. They studied the populations of children from Europe who had a diet rich in animal protein, fat, starch and poor in dietary fiber, and Burkina Faso, a rural African village where the diet is high in fiber content and low in animal protein and fat. It was found that there was a significant enrichment of Bacteroidetes and a reduction of Firmicutes in the children from Burkina Faso compared to those from Europe. Furthermore, unlike the European children, in the case of the former, there was an abundance of organisms from the genera *Prevotella* and *Xylanibacter*, both of which are known to harbour genes for cellulose and xylan hydrolysis, thus allowing a better utilization of high fibre based diets which was not the case for the European children. This study was able to establish a correlation between the type of diet and the microbiota profile of the subjects studied. That diet has an important role in developing the microbiota, is also shown by other studies where organisms associated with a high fat, high-carbohydrate diet were demonstrated to promote obesity in gnotobiotic mice[10].

Lifestyle related differences in gut microbiota have been well established between obese and lean individuals. In both mice and humans, it has been established that Firmicutes dominate the gut ecology in case of obese individuals compared to those who are lean[11,12]. Additionally, an attempt to alleviate the obese conditions in mice by changing the dietary habits leads to corresponding changes in the gut microbiota. The altered microbiota is similar to what is characteristic of lean individuals, irrespective of the diet regimen or caloric intake that has been provided. Such observations have also been reiterated by studies involving gastric bypass surgical approaches which are carried out to achieve weight loss[13,14]. It is observed that while Firmicutes are the dominant group in obese individuals before undergoing the surgical procedure, their numbers reduce drastically, following the gastric bypass surgery, and is characteristic of that seen in lean individuals.

The findings of these studies mentioned above indicate that while the microbial inhabitants of the gut are predominantly Firmicutes and Bacteriodetes, their relative abundance in an individual may vary. Factors that are responsible for this variation in gut microbiota of individuals could be dietary habits, lifestyle, *etc*. Therefore, recognition of the fact that one can modulate the health and well being of an individual by enforcing changes in the gut microbial population, has led to an increased interest in probiotics. While there is an increased awareness about probiotics and their potential health benefits, there are several problems and issues that scientists, medical practitioners, society as well as industry have to face. One of the problem lies with the inherent nature of probiotics which is its context specific health attributes as can be seen from the various studies carried out across socio-cultural groups, geographical distributions, and variation during life span, *etc*. The resultant classification of probiotics not as drugs but as food or diet supplements is, therefore, natural. There is no stringent requirement on demonstration of safety and efficacy.

Given this situation, the best approach to be able to get the maximum benefit out of probiotics would be to resort to traditional fermented foods and the probiotic organisms associated with them. The report in this issue by Balemurgan *et al*[15] is, therefore, significant in this context. They have attempted to establish the probiotic potential of lactic acid bacteria (LAB) commonly found in curd. The authors were able to isolate several *Lactobacillus* spp. from curd which is widely used in India and especially in southern India. Using standard and established approaches, they have been able to establish the probiotic potential of the LABs that have been isolated from households of a small geographical region. Several of the isolates have been demonstrated

to have very good acid and bile tolerance which is essential for these organisms to survive the harsh gastric conditions. Besides, LAB have also been shown to have antimicrobial effects on select pathogens[8]. Overall, the isolates they have obtained are diverse in terms of their probiotic features and offer access to an array of potential probiotic organisms which form a part of routine dietary habits of that region.

T. Bagchi
Microbiology & Biotechnology Centre
Faculty of Science
The M.S. University of Baroda
Vadodara 392 002, India
mailforbagchi@yahoo.com

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