



The stability of probiotics added to the food

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ABSTRACT

Probiotics have been used to improve the health of humans and animals on various aspects. Their benefits include improving the intestinal microflora balance, enhancing immune system, preventing cancer, treatment of diarrhea, allergic diseases, antagonistic activity against pathogens. Some of them have clinical trials such as Irritable bowel syndrome and cholesterol. Food products with probiotics are increasing recently with the recognition of its profits. The viability of probiotics is an important character in these products. This article is mainly about the factors need to be considered when research and develop food with probiotics such as strain selection, add lever, the effect of food ingredient and environment factors, especially their stability during storage time.

Key words: probiotics, stability, carrier

INTRODUCTION

The term probiotic, meaning “for life”, is derived from the Greek language. The concept of it was coined until the 1960’s and evolved through the years [1]. The generally accepted definition is a “live microbial feed supplement which beneficially affects the host animal by improving its intestinal microbial balance”[2].

The guidelines for the evaluation of probiotics: step one is identifying the exact strain by DNA-DNA hybridization, sequencing of DNA encoding 16S rRNA, T-RFLP; step two is in vitro evidence that examine ability to adhere to surfaces, inhibit growth and attachment of pathogens, resistance to bile salts and maybe there are more evidence need in future; step three is the safety of probiotics which can be accepted by the consumer; Step four is their efficacy in improving the health; step five is effectiveness which will be more reliable in terms of content, shelf-life and quantity; step 6 is health claims and labeling. With more and more products in the market, the criteria will be different[3].

Probiotics have been used to improve the health of humans and animals on various aspects. Their benefits include improving the intestinal microflora balance, enhancing immune system, preventing cancer, treatment of diarrhea [4], allergic diseases [5], antagonistic activity against pathogens. Some of them have clinical trials such as Irritable bowel syndrome [6] and cholesterol [7].

Probiotics and food

Traditionally, most of lactic acid and related bacteria have been applied as starter bacteria that usually been used in fermentation with a specific function or the production of ingredients. Another important application is adding the viable cells in food and feed to be nutritional complements for the health promoting food products. In this way it can keep a quantity of viable probiotics in the food which is important in the new functional foods though there are still many affective factors such as the component of food.

Food matrix formulation is a major technological factor that influences the functionality of probiotics [8]. Most reports are the application of probiotics on milk, cheese [9,10]. There are some reports on the ice cream [11], milk- and water- based cereal puddings [12], cheese-based dips [13] and sausage [14,15]. It's a great challenge that applied the probiotics in non-dairy products such as cereal products, oat and confectionary. In non-dairy products it's important to maintain viability of probiotics of formulation in shelf life since the probiotics don't usually multiply. So the survival of probiotics is critical. In these products the water activity, oxygen tension and temperature become increasingly important.

Factors that need to be considered in the development of probiotic-containing foods

The functional food with probiotics has to face some questions, such as strain selection, addition level, processing, the effect of different ingredient, stability of probiotics during storage, sensitive to oxygen, packing material and so on.

Not all the probiotics can easily be produced industrially and not all promising strains can be marketed. The first is it must have high viable counts and survival rates through the stomach. So it needs to have a good stability in the appropriate carrier. Many properties have been examined in vitro, such as sensitivity to oxygen, stability during storage, resistance to proteases of the digestive system, antioxidant ability, or adhesion to animal cells. The adhesion to animal cells is the important characteristic to be the probiotics that used in the food.

Strain selection and addition level

With the recognition of probiotics, the number will be as a function of the strain and the health effect desired. Food as the carrier of probiotics also influences the level of its activity. International Dairy Federation recommends that dairy products, such as acidophilus milk, contain at least 10^7 colony forming units (CFU) per ml of the probiotic culture. Thus, high inoculum levels should be used to make the food contain a quantity probiotics at the term of storage period on the shelves.

From the manufacturer's point of view, other technological qualities are demanded. It believed that the cells between 10^6 - 10^8 CFU/g of intestinal contents can have a significantly affect on the GI tract [16]. If the losses of probiotics can be less after passing the stomach and ability of adherence can be enhanced, then the cells contained in the products can be less. But some products on market only label they contain the probiotics and don't have the instruction about how much viable in product. Now some probiotic technology such as encapsulation can improve the viability of probiotics [17].

The carrier of the probiotics

Fermented milks and milk products are good carrier of the probiotics [18]. It's a great challenge that applied the probiotics in non-dairy products such as cereal products and confectionary. In non-dairy products it's important to maintain viability of probiotics of formulation in shelf life since the probiotics don't usually multiply. So the stability of probiotics is critical. In these products the water activity, oxygen tension and temperature become increasingly important. Many non-dairy products such as cereal products, drinks and confectionary are storage at the room temperature which is the overwhelming challenge for probiotic stability.

It reported that the fat content of yogurt mix don't seem to influence the growth of the probiotics [19]. The effect of malt, wheat and barley extracts on the viability of potentially probiotic lactic acid bacteria under acidic conditions were evaluated [20]. The results presented in this study indicate that malt, wheat and barley extracts exhibit a significant protective effect on the viability of *L.acidophilus* under acidic conditions, which could be mainly attributed to the amount of sugar present in the cereal extracts.

The environment effect on the probiotics

In addition to selecting the probiotics, the method of packaging and storing of the products is important in maintaining viability. Temperature, moisture, and air can also influence the survival of the probiotics. Temperature is an important factor for the stability of the probiotics. In food processing, usually temperature are over 65°C which applied to destroy microorganisms. Low temperature, are introduced for technological purposes. Generally it don't damage the probiotics under 45°C . *Lactobacillus acidophilus* is rather sensitive to heating [21]. The POX of *Lactobacillus plantarum* C17 was completely inhibited at 37°C , while the activity of NPR slightly increased at 25°C [22].

So it is better to add the probiotics after the temperature below 45°C . The packing material also have the effect on the stability of probiotics, Some reports point the magnesium ion in the packing material can increase the stability of probiotics.

CONCLUSION

Now the research on the probiotics mainly include finding the novel ones and identification of them [23], the genetics of probiotics which could help know the characteristic well and improve the characteristic of it [24], their clinical trials [25] and their application in foods. If the probiotics is used in food, no matter how well the characteristic of it or their clinical trials, the stability of it in foods is the determination factors weather it is suitable to be chosen. Though there are some difficult need to solve, probiotics used in food have a potential market for its long using history and their profits for people health [26].

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