Development Study of Lactic Acid Bacteria-based Functional Food: Diversity and Characteristics of Food Matrix (A Review)

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ABSTRACT

sThe diversity of traditional fermented foods in Indonesia reflects the importance of lactic acid bacteria. Currently, lactic acid bacteria-based functional foods are growing in Indonesia. This research aimed to collect and study about diversity and characteristics of lactic acid bacteria-based functional food. This study was performed by qualitative method, with a literature review. This study shows that the development of lactic acid bacteria-based functional food has many variations, dominated by beverages and other types with specific characteristics. Many products use pretreatment to protect LAB during the process; both encapsulate or add other materials. In conclusion, this study provides information about the diversity and characteristics of each LAB-based product. T(1)his study might contribute to increasing the development of LAB-based functional food so it can be enjoyed as the usual diet and consumed without a specific dose.

Keywords: *Lactic acid bacteria; functional food; fermented; probiotic*

INTRODUCTION

Recently, foods have been consumed by people not only to satisfy their hunger but also to fulfil nutrient intake and also to improve their health status (1). This refers to the concept of FOSHU（Food for Specified Health Uses), or functional food, processed foods containing one or more functional components based on scientific assessment (2). Much research explained that probiotics could act as a functional food. Among the microorganism known as probiotic, LAB also plays a specific role in functional food. LAB is also known as a starter in the manufacture of fermentation products and plays a crucial role in forming bioactive components (3). Indonesia has many kinds of traditional fermented food with indigenous LAB. It is known that the foods featuring lactic acid bacteria (LAB) with potential health benefits have expanded over the years from traditional dairy products to dairy and non-dairy products (4). The impact of LAB on the human body was reported (5)(6)(7)(8), but the interactions between LAB and their delivery of food remain scarce. In order to give benefit humans, LAB must need to be viable and also functional. It also needs to make them very attractive in the design of functional food carriers to protect them during food processing and gastrointestinal tract. The research on the LAB-food matrix remains challenging because of their profusion and the diversity of methods (9).

All these new carriers must be compared for their efficacy in protecting, carrying, and delivering LAB. This research aimed to collect and study about diversity and characteristics of the food matrix of lactic acid bacteria-based functional food in Indonesia. These findings may help the optimation of food matrix design in LAB delivery.

MATERIAL AND METHODS

This method of this study is qualitative method. Several research paper especially about functional food from science direct, scopus and google scholar was analysis in this paper. The data was focused on food matrix on LAB-based functional food, adopted interpretive analytic (10).

RESULT AND DISCUSSION

This research aims to collect and study about diversity and characteristics of the food matrix of lactic acid bacteria-based functional food in Indonesia. Viability issues are essential in the LAB to benefit its host. The LAB dosage is needed to excess 108-109 viable cells to benefit its host (11). This research aims to collect and study about diversity and characteristics of the food matrix of lactic acid bacteria-based functional food in Indonesia. Viability issues are essential in the LAB to benefit its host. The LAB dosage is needed to excess 108-109 viable cells to benefit its host.

As functional food, LAB can be grown in either an intermediary industrial medium from which they are harvested or in the food matrix(12). They are added to food products as frozen, dried, encapsulated, or liquid cultures(13). In Indonesia, LAB is added to frozen or liquid cultures, fruit jams, and mayonnaise. LAB-based functional food in Indonesia supported local product-based food diversity. Indonesia has many dairy and non-dairy products containing LAB, such as *dadih, tape, tempoyak, and oncom* (14). The development of the food matrix of LAB-based functional food in Indonesia is shown in Table 1.

Table 1. Development of Food Matrix of LAB-based functional food

Strain	Food Matrix Design	References
Lb. casei	Yoghurt	(15)
Lb. bulgaricus and Streptococcus thermophilus	Edamame Yogurt	(16) (17)
Lb.plantarum BSL	Sweet Corn-Mung Bean Yogurt	(18)
Lb.plantarum 2C12	Tempe yoghurt	(19)
Lb. plantarum Dad 13	Salacca Yogurt drink	
Lb acidophilus	Yoghurt with sweet potato extract	
	Fermented goat-milk	
Lb. plantarum	Fermented fruit juice	(20)
Lb. sp F213	Tamarillo juice	(21)
Lb. casei Sp Shirota	probiotics drinks	(22) (23)
Lb. sp F213	Snake Fruit probiotic Drinks	(24)
Lb. plantarum Dad 13	Fermented rice drink	(25)
	Guava drink	
	Tape ketan probiotic drink	
Lb. plantarum, Lb. bulgaricus and Streptococcus thermophilus	Rosella beverages	(26)
Indigenous dadih strain (36 strain)	Dadih	(27)
Lb. plantarum and Lb. casei	Mayonnaise	(28)
Lb. acidophilus ATCC 314	Pineapple jam	(29)
Lb. platarum BSL Lb. plantarum 2C12	Salacca jam	(30)
Lb. acidophilus 2B4	Soursop sweet cakes	(31)
Lb. rhamnosus R23		

The ideal food matrix for adequate LAB protection, carrying, and delivery is

the optimization of seven essential parameters such as; pH, food structure, buffering capacity, fat content, nutrient and oxygen content and also a_w(13).

Table 1 shows the food matrix of LAB-based functional food, not only dairy but also non-dairy products. In Indonesia, non-dairy products as food matrix are widely needed, mainly to provide functional food for people with lactose intolerant, vegan trends and other factors such as unfavourable cholesterol content.
This type of food matrix gives advantages and also disadvantages to LAB protection. For example, many research there known that no LAB viability difference was reported between dairy and non-dairy products (32,23,33,34), but milk always proved to be the most efficient medium for LAB protection during the process(13). This is because of the presence of lactose-hydrolyzing enzymes and proteolytic systems involved in casein utilization. On the other hand, the inoculated method seems to affect the viability and shelf life ratio, but research on this topic remains scarce.

Dairy products remain effective LAB carriers because of their structure. Therefore, it could support LAB alive, but on the other hand, the development of non-dairy LAB carriers is also increasing.

Development Treatment To Protect LAB

LAB is beneficial bacteria that have potential health effects, including improving microbial balance, blocking pathogens bacteria, stopping intestinal dysfunction, and lowering cholesterol(11). In general, many of these effects have been reported in live LAB. LAB can be grown in a medium from which they are harvested or in the food matrix. The LAB could be killed during the processing of food products. Cell death of LAB occurs due to plasma membrane leakage. Many treatments were added to prevent cell death, such as encapsulated (24,30,31) and additives (17,25,35) and also gives them appropriate food matrix design for effective delivery (13). Many studies have been published on drying and encapsulation techniques (24,31,36,37), and this method showed better protection to LAB during food digestion. Adding other substrates is needed to protect the cells from damage during the food process. However, nowadays, it is a trend that studies for the effects of killed-LAB are increased. The killed-LAB exhibited the probiotic effects and live-LAB, but the effects of live-LAB were generally better than those of killed-LAB (38).

CONCLUSION

This study aims to collect and study about diversity and characteristics of lactic acid bacteria-based functional food in Indonesia. This result showed types of functional food that developed in Indonesia. Optimising food matrix design in terms of effective LAB delivery should be continued. These findings can be actionable items that can lead to further study.

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