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Perspective

Addresssing to Food Security with Lactic Acid Bacteria

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Food security may refer to (USAID): "When all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life." Therefore there are four dimensions/pillars integrated into food security: availability, accessibility, utilization, and stability. The impact of climate change has a direct effect on the productivity of crops, livestock, fisheries, and aquaculture sector. Low productivity in agricultural areas could influence food availability. The low availability of food could increase the prices of major crops in some regions. Under these conditions, food accessibility of people has been affected. When non-farm incomes fall, when food prices rise, or when the productivity of farm households suffers, food access can be agitated. In turn, vulnerable people especially those who are lower incomes sacrifice to meet their nutritional requirements, or in other words, food utilization is decreased. Proper food utilization requires satisfactory of food contains (the energy, protein, and nutrients necessary for a healthy and productive life), food safety and food's nutritional qualities. Nutrition is likely to be related impact of lousy food availability and food access. Fluctuations in food availability, access and utilization can impact on upsetting the stability of individuals' and government food security strategies. Thus, the dimension of food stability is finally affected. It is obvious that adaptation approach is necessary to address the improvement of food security.

Many authors have been highlighting how to improve food security, but here another perspective is focused on the importance of lactic acid bacteria.

What are the Roles of Lactic Acid Bacteria (LAB)?

One of the alternatives strategies in adapting to increase food security could be the use of lactic acid bacteria (LAB). These LAB are GRAS status (generally recognized as safe), a group of Gram-positive bacteria that ferment carbohydrates to almost entirely lactic acid (homofermentation) or a mixture of lactic acid, carbon dioxide, and acetic acid and ethanol (heterofermentation). These bacteria also produce diacetyl, acetaldehyde, hydrogen peroxide, and a bacteriocin. These compounds contribute to the flavor and texture of fermented foods and may also contribute to the inhibition of undesirable microbes. Examples of genera of lactic acid bacteria are Streptococcus, Lactobacillus, Lactococcus, Pediococcus, and Leuconostoc. LAB in foods is of interest not only for their role in fermentation but also for their role in promoting positive health impacts. Therefore, the LAB is essential to improve food security.

The Importance of LAB in Reducing Loss

1. Thru Improving Safety and Shelf-Life.

Lactic acid bacteria are known to produce organic acid (mainly lactic acid) and bacteriocins. Both these compounds can inhibit the growth of other microorganisms (pathogen and spoilage microorganism). Therefore these can improve shelf life. These are the examples of this application:

• Lactic acid bacteria as biocontrol (alternative chlorine) for fresh-cut fruit and vegetables, minimally processed fruits and vegetables.

• Lactic acid bacteria as a biocontrol in meat and fish stored in low temperature.

• Lactic acid bacteria in the pickling of fresh fruit and vegetable (fermentation method in which salt are added as the main ingredient). Carrot and green chili could be preserved up to 4 months by pickling fermentation.

2. The Importance of LAB in Reducing Loss Thru Improving Yield

LAB has a role in increasing yield. The best example of this is an application of LAB in the form of probiotic to control bacteria disease in aquaculture and livestock. Disease outbreaks are recognized as essential constraints to aquaculture production and trade since the antibiotic has become a matter of growing concern. The use of lactic acid bacteria as microbial control agents in the form of probiotic as supplementation diet will maintain good water quality, and lower pathogenic bacterial loads in fish ponds, therefore the yield could be improved.

3. Thru Improving Efficiency of Process

The role of LAB in improving efficiency process can be shown in the application of lactic fermentation to increases starch extractability in sweet potatoes. These tubers contain 15-30% of starch, but the yield is usually less than 15%, even for the high starch varieties. Lactic acid bacteria will produce the enzymes that breakdown pectin and cellulose so the starch will then be easily extracted. This process is a challenge for us to improve the starch yield in other starch sources that have a low yield, e.g., Tiger nut, Taro, Bread fruit and others to improve yield.

The Importance of LAB in Diet Change

Addressing the needs for rice, substitution of them with other local food is needed. The best example is uses of sweet potato flours as an alternative to making bread and noodle as a rice substitute. Sweet potato (SP) is widely grown, drought tolerance and positive role in food security. However, in its nature, when sweet potatoes were processed into the flour, has some drawback properties when applied on food products. In this case, lactic acid fermentation could be aimed to improve SP flour properties. Fermentation may change the amorphous region of the starch granule as well as the chemical components and thereby modify the physicochemical properties of the starches and the flour. Use of this modified flour in products increases whiteness, increases loaf volume, improves texture and aroma, decreases the broken noodle strand.

Another way of rice substitution is in the form of rice analog (RA). It can be made from almost any flour into a rice-grain-like shape and is cooked similarly as original rice. LAB has the role in decreasing stickiness properties of the flour during processing of rice analog (RA), therefore it improves the "molding process" to grain rice like shape. This is the challenge to modify properties of the underutilized flour so they could be suitable for the main ingredient for noodle, bread, and rice analog.

Another Role of LAB in Bread Production

The dough is usually leavened by bread yeast, which ferments dough sugar and produces mainly carbon dioxide and alcohol. However, gas producing microorganisms such as heterofermentative lactic acid bacteria could be used for leavening of dough instead of bread yeast alone. On the bread dough, lactic acid bacteria fermentation improves texture changes, contributes directly to bread flavor, and increases the loaf volume, as well as the extended shelf life of bread by inhibiting the growth of microbes.

The Role of Lactic Acid Bacteria in Meat Substitute

One of the alternatives for meat substitute is Tempe. This food is a highly nutritious food, easily digestible and delicious product. Tempe meets an increasing demand from consumers looking for high-quality meat replacers as this food has high protein content (40-50% of dry matter). It serves as a tasty protein complement to starchy staple foods such as rice, and it can replace meat. In Tempe fermentation, soybeans are soaked overnight before inoculation with starter culture containing *Rhizopus oligosporus* as the first microorganism. LAB takes place during the soaking, and some growth of lactic acid bacteria commonly occurs during the stage of mold growth. The existence of the LAB is known to control the Enterobacteriaceae bacteria and some bacterial pathogens in Tempe. Also, LAB is known to reduce an antinutritional substance in soybean.

The Role of LAB in Increasing Food Utilization

Lactic acid bacteria have an essential role in increasing food utilization by fermentation. The fermented product such as fruit and vegetable juice fermented, fermented milk, fermented meat and fish, fermented drink, fermented nondairy milk, seem to provide consumers with more varieties in their food choices. Also, by LAB fermentation, the product could be preserved and at the same time getting beneficial properties. This includes a nutritive value of the product through increased vitamin levels, and improved digestibility, microbiological safety, reduces toxicity and removing anti-nutritional factors.

The lactic acid content of fermented food product may enhance the utilization of calcium, phosphorus, and iron and also increase the absorption of iron and vitamin D. The challenge in the future is how LAB fermentation plays a role in harnessing underutilized alternatives sources to produce acceptable food products, how to increase the range of raw materials that probably are not utilized in some region but a potential for diversification after being fermented. These include edible insect, mollusk, and underutilized fruit and vegetable, and underutilized root and tubes. Underutilized plants are extremely drought resistant, and can be grown under extreme climatic conditions; hence, it is a promising crop against global climatic changes. Many traditional vegetables and underutilized legume crops are an essential source of vitamins, micronutrients, and protein and, thus, a valuable component to attain nutritional security. Lactic fermentation of composite flour/water mixtures containing 10, or 20% powdered roasted mealworm larvae resulted in successful acidification and was demonstrated effective in safeguarding shelf-life and safety by the control of Enterobacteria and bacterial spores. In some region, there is the typical food made from insects such as worm, crickets, and grasshoppers. In Indonesia for example, there are the sago maggot (Timika, Papua), the nyale sea worm (Lombok), grasshoppers chips (Gunung Kidul, Jogjakarta), fried crickets (Ciamis, West Java), fried teak tree cocoon and wasps (East Java).

The Roles of Lactic Acid Bacteria in Strengthening the Potential of Local Added Value Product

There are many added value food products could be produced by mean of lactic acid fermentation. These include fermented fish such as "rusip," fermented prawn, fermented milk and fermented nondairy milk, fermented fruit and vegetable. Beside food, the biomass and waste could be value added in which lactic acid bacteria involved to produce commercial products. The examples of these are silage, fertilizer, and compost.

Conclusion

Lactic acid bacteria (LAB) play a significant role in addressing food security. A big challenge for future, therefore, lies in the how more work to be done and how more promoting LAB and underutilized food resources incorporation, into the grand strategy, so that more beneficial can be maximum derived in addressing to food security.

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