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BIOSYNTHESIS OF FOLIC ACID AND THIAMINE IN FERMENTED FOODS BY LACTIC ACID BACTERIA

Lactic acid bacteria (LAB) are widely employed in food fermentation processes for the biosynthesis of certain important products. Fermented food provides plenty of vital nutrients and bioactive components that affect a number of functions of human body in a positive way. LAB have capability to synthesize water-soluble vitamins specifically those included in the B-group [1].

The possible strategies to increase B-group vitamin content in cereals-based products may lead to the elaboration of novel functional fermented foods. In fermented milk products like curd, yogurt, buttermilk, cheeses and other milk and cereal based fermented foods. The biosynthesis and liberation of vitamins have also been reported by the aid of LAB fermentation. In addition, the use of genetic strategies to increase vitamin production or to create novel vitamin-producing strains.

Most of the vitamins cannot be synthesized by humans and animals; however several species of bacteria, yeasts, fungi and algae may serve to produce folic acid, vitamin B12 or cobalamin, vitamin K2, riboflavin, thiamine, and other vitamins [1].

Folic acid belongs to the water-soluble vitamins. These vitamine cannot be synthesized by mammalian cells. Folate is important for DNA and RNA synthesis and amino acid conversion. The daily-recommended intake for an adult varies between 200 and 400 μg. A low folate intake has been associated with the risk of cardiovascular diseases. Low plasma folate concentrations correlate with elevated levels of homocystein, which has been recognised as a risk factor in the coronary heart disease. Folic acid interacts with vitamins B6 and B12 and other nutrients in order to monitor blood levels of homocysteine. High levels of homocysteine are connected with heart disease, however researchers are not confident whether this amino acid is a cause of heart disease or just a marker that pointed who can have heart disease.

Many *Lactobacillus spp*. and *Lactococci spp*. Including *L. Plantarum, L. rhamnosus, L. bulgaricus, L. Lactis* can be used for industrial production of folate. Similar to this, it is observed the increasing of production of vitamin B9 after administration of probiotic *Bifidobacterium* strains *in vitro* [1].

The genes for folate biosynthesis have been identified in *L. lactic*, in *L. Plantarum* and in *L. delbrueckii* ssp. Bulgaricus, but in the last one, some of them are missing. Not every *Lactobacillus* is able to produce folate because the genes involved in folate biosynthesis are lacking in the genome; this is the case for *L. gasseri, Lactobacillus salivarius, L. acidophilus* and *L. johnsonii.* Through

metabolic engineering, it is possible to increase folate levels in *L. lactis, L. gasseri* and *L.* Reuteri [2].

Bifidobacterium species are generally believed to produce group B vitamins including folate, cobalamin, pyridoxine, riboflavin and thiamin. The ability of Bifidobacteria to produce folate is dynamic though it is strain specific and depends on the medium. Optimization and selection of suitable growth conditions can result in high levels of folate per cell unit biomass. Recently, 19 strains of bifidobacteria were screened to find main folate forms composition in synthetic folate-free and complex folate-containing media. There are two strains of *B. adolescentis* and one strain of *B pseudocatenulanum* being the top-three producers.

Vitamin B1 (thiamine) in the form of thiamine pyrophosphate (TPP) is an essential cofactor for enzymes that decarboxylate α-keto acids, including α-ketoglutarate dehydrogenase, branchedchain α-ketoacid dehydrogenase, and transketolase, during amino acid and carbohydrate metabolism.The demand of thiamine is increased under high metabolic conditions such as fever, increased muscular activity, pregnancy and lactation and also under surgery and stress.

The clinical picture of thiamine deficiency is, however, usually divided into a dry (neuritic) type and a wet (cardiac) type. The disease is wet or dry depending on the amount of fluid which accumulates in the body due to factors like cardiac function, kidney lesions, etc. even though the exact cause for this oedema has never been successfully explained. Many cases of thiamine deficiency show a mixture of the two main features and are more properly termed thiamine deficiency with cardiopathy and peripheral neuropathy.

Production of thiamine is detected of the strain-dependant as all tested strains of *B.bifidum*, *B. longum, B. infantis,* and some of *B. Breve*. These bacterias are high producers, besides B. adolescentis and B.longum are manufactured of thiamine and nicotinic acid. Recently, it was shown that a slight (but not statistically significant) increase in the thiamine and pyridoxine concentration occurred as a result of soy fermentation with *S. thermophilus* ST5 and *L.helveticus* R0052 or *B. longum* R0175 [2]. As the result of the LAB fermentation in yoghurt, cheeses and other fermented products the concentration of thiamine in milk was also positively influenced (11% increase) following 48 h of fermentation with *B. longum*. Recently, it was shown that a slight (but not statistically significant) increase in the thiamine and pyridoxine concentration occurred as a result of soy fermentation with S. *thermophilus ST5 and Lactobacillus helveticus R0052 or B. longum R0175 [2]*.

The usage of vitamin-producing microorganisms is more natural and economically efficiently in comparison with enrichment of vitamines that obtained by chemical methods. Such product would be commercially important because it has value-added effect without increasing of production costs. That’s why it would allow producing goods with elevated concentrations of vitamins that will be provide the development of novel functional foods with increased nutritional value.

It is expected that the food industry will take the next step to use this information for selecting vitamin-producing strains as part of their starter cultures to produce fermented products with elevated levels of these essential compounds. Such products would provide economic benefits to food manufacturers as increased

'natural' vitamin concentrations would be an important value-added effect without increasing production costs. Consumers would obviously benefit from such products as they could increase their vitamin intakes while consuming them as part of their normal diet [2].

So, research has demonstrated that nutrition plays a crucial role in the prevention and reduction of a lot disease and functional food will provide health benefits and enhance performance above its nutrition value.

References:

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РАДІОЧУТЛИВІСТЬ ЛИШАЙНИКІВ ДО ДІЇ ІОНІЗУЮЧОЇ РАДІАЦІЇ

Є регіони, де популяції живих організмів мешкають в умовах високого природного радіаційного фону. Це відбувається і в природних умовах, і на територіях техногенно забруднених радіонуклідами. Такими є природні популяції Кіровоградщини. Тут спостерігається велика кількість генетичних порушень, а популяції стають більш стійкими до радіаційного навантаження. Вони адаптувалися до підвищеного фону, збільшилася їх радіорезистентність. Хронічне малоінтенсивне опромінення понад еволюційно звичний рівень змінило структуру популяцій і її реакцію на зовнішній подразник.

Лишайники є симбіотичними організмами автотрофної водорості й гетеротрофного гриба. Їх давно використовують як біоіндикатори навколишнього середовища. Пояснюється це якісними змінами функцій симбіонта. Слань лишайників взаємодіє з середовищем як фізичне тіло і як губка всмоктує із повітря та опадів все, що здатна поглинути, в тому числі і радіоізотопи.

Стійкість лишайників до дії іонізуючої радіації виявляли підчас проведення експериментів у природі і лабораторії. Джерело γ-випромінювання знаходилося в шахті по видобутку урану і на промисловому майданчику. Методика польових робіт передбачала відбір зразків лишайників в однорідних ландшафтах і геоморфологічних умовах на відстані від 1 до 50 км від джерела радіоактивного забруднення. Особлива увага приділена дослідженню територій у напрямку переважання панівних вітрів. Вміст радіонуклідів у лишайниках визначали спектрофотометрично. Спостереження проводилися на макрорівні