

PRESS RELEASE

Aug 3, 2021

[Research News]

Results of joint research with Kyoto University in an international journal.
posted in 【npj Science of Food article】

Sun Chlorella Corp. (Head office: Shimogyo Ward, Kyoto City, Representative and Chairman: Futoshi Nakayama, hereinafter, "We") conducted a collaborative study on the beneficial effects of phenethylamine contained in Chlorella with the research group of professor Kenji Sato and his colleagues in the field of marine functional biology at the Graduate School of Agricultural Studies, Graduate School of Agriculture and Biology at the University of Kyoto (hereinafter "Kyoto University"). The research results were published online in the academic journal "npj Science of Food" published by Springer Nature on July 23, 2021.



<Background of the Study>

Liver cancer has been attributed to drinking, hepatitis B, and hepatitis C. In recent years, however, it has been found that liver cancer also occurs in fatty livers caused by obesity and lifestyle-related diseases. In Japan, the number of patients with liver cancer is increasing due to the shift of the meal to Europe and America. Among them, fatty liver, which occurs due to the exclusion of alcoholic drinking, is called "non-alcoholic fatty liver disease" [NAFLD], and it is believed that more than 10 million patients are found in Japan. (※1)

In addition, lipid-oxidative enhancement is considered to contribute to the development of NAFLD conditions. In our previous work, Chlorella hot water extract prolonged the life span of the reduced antioxidant capacity of Sod1 mutant Drosophila and reported the identification that attributes functional constituent to the monoamine, phenethylamine. (※2)

In this study, rodents fed a high-fat diet were fed with extracts of Chlorella and phenethylamine to elucidate the mechanisms of pathological development of new NAFLD and the functionality of phenethylamine.

<Outline of research results>

This is the first finding that phenethylamine, by controlling methylglyoxal (MGO) through increasing glyceraldehyde 3 phosphate dehydrogenase (GAPDH) protein, has revealed the molecular action targets of high-fat diet-induced hepatic damage alleviation and the benefits of phenethylamine.

Methylglyoxal (MGO) is generated from substrate of GAPDH. Thus, increase of GAPDH means less MGO level, in which each factor has inverse correlation. These facts also indicate that MGO as precursors of toxic end-glycation products triggers oxidation of accumulated lipid, which generates malondialdehyde and consequently induce liver damages.

This study used a rodent model to reveal the following two points:

- ① Phenethylamine not only significantly alleviated the oxidation and liver damage of lipids generated by the donation of a high-fat diet, but also markedly reduced the accumulation of lipids in the liver.
- ② Ingestion of a high-fat diet can accumulate lipids in the liver, reducing GAPDH and, consequently, increasing MGOs that induce lipid oxidation. Chlorella hot water extract (C.G.F.) and phenethylamine restored GAPDH content and suppressed lipid oxidation and hepatic damage by suppressing the formation of MGOs.

<Term Description>

*Glyceraldehyde 3 phosphate dehydrogenase (GAPDH)

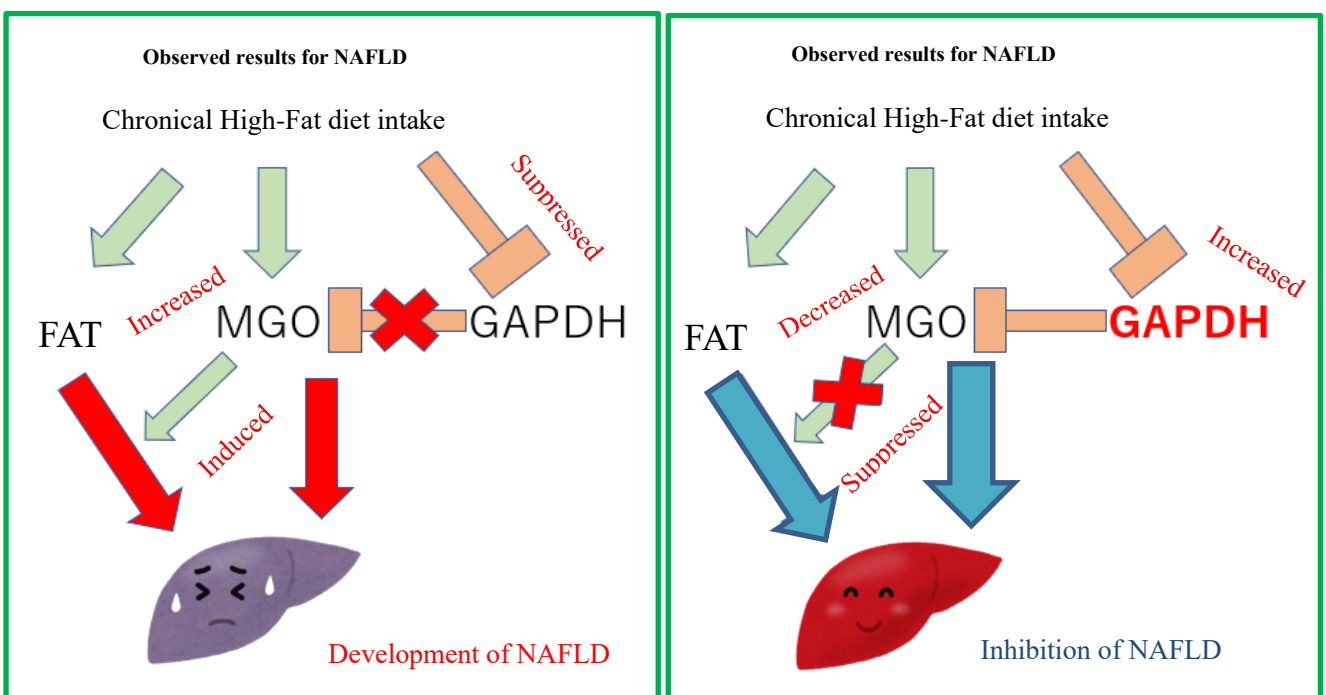
Critical enzymes involved in the glycolysis of energy production pathways. Recently, new functionalities such as causing cell death as a sensor of nitric oxide stress have been reported.

*Methylglyoxal (MGO)

Metabolites elevated in diabetes, uremia, and sepsis that are precursors of toxic end-glycation products that are normally produced.

[No Chlorella water extract or phenethylamine].

[There are chlorella water extracts and phenethylamine].



<Future Perspectives>

This collaborative study revealed the molecular action targets of high-fat diet-induced hepatic damage alleviation and the benefits of extremely trace monoamines, represented by phenethylamine. It is expected that this will not only contribute to the creation of new values for extremely trace ingredients contained in foods in the future, but also to the application of fermented foods used in Chlorella and Japanese diets to the health benefits.

<What is Chlorella>

Chlorella is a class of green algae that live in fresh water. It is attracting attention as a plant-based whole food (*3) that contains nutrients such as protein, vitamin B12, folate, and iron in a well-balanced manner. Chlorella has the advantage of being able to consume a variety of nutrients in whole compared to supplements specializing in single ingredients that are widely distributed on the market.

(※1) Source: Guideline <https://www.jsge.or.jp/guideline/disease/naflid.html> of the Japanese Society for Digestive Diseases

(※2) Source:

(※3) Plant-based whole food: A vegetable food that can take ingredients whole without processing or refining.

<About information about the article>

※Papers can be viewed freely with open access.

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