NEWS RELEASE

Research Suggests Inulin Intake Reduces Risk of Death from Novel Coronavirus Infection in a Hamster Model

Results of joint experiments are announced by Metagen, Inc., Institute for Advanced Biosciences, Keio University, Institute of Medical Science, the University of Tokyo and Teijin

Tokyo, Japan, March 28, 2024 --- Metagen, Inc., the Institute for Advanced Biosciences, Keio University, the Institute of Medical Science at the University of Tokyo and Teijin today announced results from their joint research into the effects of inulin intake on the risk of death from the novel coronavirus (SARS-CoV-2) in a hamster model. Experiments by the four parties showed that feeding inulin to the novel coronavirus-infected Syrian hamsters used as an animal model increases the amount of secondary bile acids derived from gut microbiota in the stool and serum. As a result, the risk of death due to the novel coronavirus infection is significantly reduced.

Summary of the results

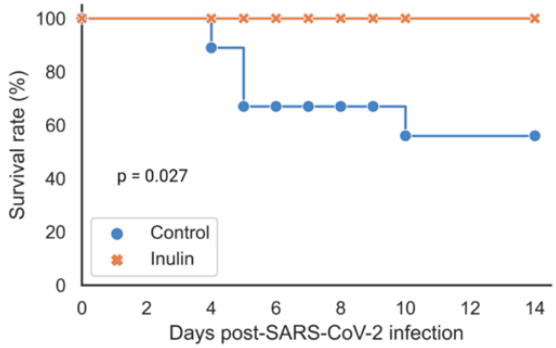
Hamsters were divided into two groups based on diet: a normal diet (control group) and a diet supplemented with 5 percent inulin, a type of prebiotic, which replaced 5 percent of the starch in the normal diet (test group). Following two weeks of each diet, the hamsters were nasally infected with the SARS-CoV-2 virus. The survival rate at 10 days after infection was 60 percent in the control group and 100 percent in the group fed a diet supplemented with 5 percent inulin (Figure 1).

In the stool and serum of hamsters in the test group, the amount of deoxycholic acid (*1), a secondary bile acid derived from gut microbiota, was significantly higher than in the control group (Figure 2).

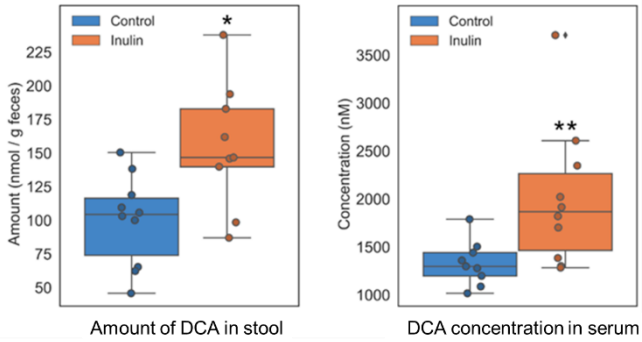
Research by Associate Professor Takeshi Ichinohe of Institute of Medical Science, the University of Tokyo and Project Professor Shinji Fukuda of Institute for Advanced Biosciences, Keio University and the CEO of Metagen, Inc. have previously revealed that deoxycholic acid suppresses the severity of the novel coronavirus infection (*2). This study has shown that inulin intake increases the production of deoxycholic acid and can significantly improve the survival rates compared to the control group.

(*1) Deoxycholic acid (DCA): A secondary bile acid produced by gut bacteria. It has been reported that it affects immune and metabolic function.

(*2) Nagai et al., High body temperature increases gut microbiota-dependent host resistance to influenza A virus and SARS-CoV-2 infection. *Nat Comm.* 2023;14: 3863



<Figure 1: Survival rate of hamsters after infection with the novel coronavirus>



<Figure 2: Amount of deoxycholic acid in stool and serum after inulin intake>

Metagen, Inc. was established in 2015 with the aim of achieving the health of each individual through “Gut design,” an approach based on the differences in each individual’s gut environment. The company aims to create a market for the gut design through carrying out all the way from designing gut environment research to social implementation.

Since 2016, Teijin has been selling BARLEYMax™ Super Barley as a prebiotic material that feeds intestinal bacteria. Also, since 2018 it has been selling inulin, a water-soluble dietary fiber derived from chicory, a plant in the Asteraceae family. In addition, in 2020, the company began handling probiotic materials, a general term for microorganisms with beneficial effects on health, such as lactic acid bacteria. In 2022, Teijin established Teikoku Meguro Research Institute, a manufacturing base for probiotics.

In 2019, both companies conducted *in vitro* experiment within the “Gut Design Project” facilitated by Metagen, Inc., and found that yogurt containing *Bifidobacterium* and inulin produced significantly more short-chain fatty acids, such as acetic acid, compared to regular yogurt containing only lactic acid bacteria (internal data).

As many scientific papers have reported on the positive effect of inulin on immune function, the four parties decided to verify the preventive effect of inulin regarding severity of infection with the novel coronavirus through animal tests. They have been conducting joint research on this theme since December 2020.

Metagen, Inc. and Teijin will continue to collaborate with research institutions to contribute to building a healthy society by acquiring new evidence regarding prebiotics and probiotics, including inulin.

Metagen, Inc. will continue to promote research and development focusing on the stratification of the gut environment, and strive to achieve zero disease through frontier science.
Teijin will continue to provide functional food ingredients, backed by scientific evidence, which are useful for health based on the technology and knowledge it has cultivated over the years.

About Metagen, Inc.
Metagen, Inc. was established in 2015 with the aim of achieving zero disease through controlling the gut environment with frontier science. Metagen, Inc. aims to create a society in which every individual can control their gut environment through an unique approach, the “Gut Design”, in which a suitable solution is provided to each individual based on differences in gut environment. Metagen, Inc. will endeavor to seamlessly bridge the fundamental gut environment research to social implementation in order to fully utilize the potential of gut environment.
Visit https://metagen.co.jp/

About the Institute for Advanced Biosciences (IAB), Keio University
IAB is a full-fledged bioscience research institute established in April, 2001, at the Tsuruoka Town Campus (Tsuruoka City, Yamagata Prefecture, Japan). This research institute uses cutting-edge biotechnologies to comprehensively measure and analyze human and microorganic cellular activity, conduct computer analysis and simulation, and apply findings to medical, environmental, and food sciences. IAB is attracting attention from around the world as a pioneer in the new life sciences field that makes full use of IT in this way called Integrated Systems Biology.
Visit https://www.iab.keio.ac.jp/en/index.html

About The Institute of Medical Science, The University of Tokyo (IMSUT)
IMSUT was established by Dr. Shibasaburo Kitasato in 1892 as the Institute of Infectious Diseases (IID). In 1967 it was then reorganized and underwent a name change from IID to IMSUT. With a 127-year history, IMSUT explores the universal truth of biological phenomena and the principles of diseases. Through this exploration, IMSUT aims to contribute to all of human society by offering development of innovative disease prevention and treatment strategies and their social implementation. To that end, IMSUT emphasizes the free and interdisciplinary research environment in which various disciplines such as computer science, the natural sciences, engineering, agriculture, pharmacy, medicine, ethics, public policy studies, etc. can mutually inspire and build off each other with "medical science" as a keyword.
Visit https://www.ims.u-tokyo.ac.jp/imsut/en/index.html

About the Teijin Group
Teijin (TSE: 3401) is a technology-driven global group with two core businesses: high-performance materials and healthcare solutions. Established in 1918 as Japan’s first

rayon manufacturer, Teijin today comprises some 170 companies employing 20,000 people in 20 countries. Through “Human Chemistry, Human Solutions,” Teijin relentlessly strives to aims to be a company that supports the society of the future by protecting the global environment and addressing the needs of people and communities. Teijin posted consolidated sales of JPY 1,018.8 billion (USD 7.6 billion) and total assets of JPY 1,242.4 billion (USD 9.2 billion) in the fiscal year ending March 31, 2023.

Press Contact
Investor and Public Relations Department
Teijin Limited
pr@teijin.co.jp