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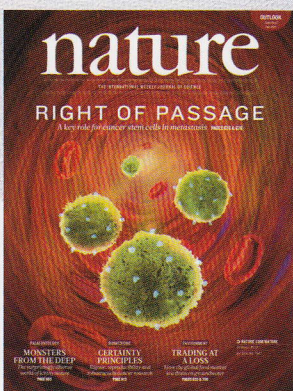
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### FOOD SCIENCE IN JAPAN



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natureresearch

### Brown rice for diabetes

In southern Japan, researchers are working with a food and pharmaceutical company to develop fermentation-based beverages and supplements to prevent and treat obesity-diabetes syndrome. Hiroaki Masuzaki of the University of the Ryukyus in Okinawa and colleagues are investigating brown rice, which has long been known to improve glucose tolerance and prevent the onset of diabetes.

The researchers tested the hypothesis that brown rice specifically contains several metabolically-beneficial

compounds not found in other grains.

The endoplasmic reticulum (ER) is a cellular network of tubules responsible for synthesising, folding and trafficking proteins within cells. In various diseases, 'unfolding' proteins accumulate in the ER, a condition called ER stress. These unfolding proteins are toxic to cells and induce apoptotic cell death. In recent years, studies have shown that the pathophysiology of obesity and diabetes is closely related to exaggerated ER stress in obese-diabetic mice. Notably, the fermentation-

based gamma-oryzanol-rich beverage produced by Aizu Tenpo Co.,Ltd. showed strong potential to improve the imbalance of gut microbiota in conjunction with the reduction of ER stress, says Masuzaki.

Unfortunately, the gastrointestinal tract is inefficient in its capacity to absorb gamma-oryzanol. So Masuzaki and his team, including colleagues at SENTAN Pharma Inc., encapsulated the compound in polymer poly (DL-lactide-co-glycolide) nanoparticles. They found that a single bi-weekly oral dose of 'Nano-Orz' markedly improved

glucose and lipid metabolism in obese-diabetic mice compared to regular gamma-oryzanol. It also markedly reduced ER stress in various tissues.

The team is now investigating the potential benefits of gamma-oryzanol in cognitive impairment, decreased physical activity, and addiction to alcohol, nicotine and dietary animal fats, all of which are often associated with obesity and diabetes. ■



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## Food for movement

Functional foods that could improve the locomotor system are being developed with the aim of **HELPING OLDER PEOPLE RETAIN INDEPENDENCE** while also reducing medical costs.



Ryuichiro Sato  
The University of Tokyo

**The locomotor system** refers to human muscular and skeletal mechanisms that control body movements. To maintain a healthy locomotor system, a proper diet and regular exercise are crucial. But, getting enough exercise is not always easy for elderly

people, which is where functional foods could help.

"A proper diet occasionally supplemented with functional foods could prevent muscle atrophy," says Ryuichiro Sato, Professor at the University of Tokyo.

Sato and Yasutomi Kamei, Professor at Kyoto Prefectural University, are leading basic research on the subject as part of a consortium on functional foods that consists of seven research groups. So far, they have found that AMP kinase



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and PGC-1 $\alpha$  genes in skeletal muscle, which are normally triggered by exercise, are associated with enhancing metabolism and muscle protein synthesis, respectively. This finding could be used to develop compounds that could mimic the effects of exercise, without the body actually doing any exercise, says Sato.

They also found that some of the genes classified as G protein coupled receptors contribute to an increase in the size of skeletal muscle, known as muscle hypertrophy. Whereas, E3 ligases — enzymes that connect a degeneration marker to proteins — accelerate muscle protein degradation.

Other projects are investigating potential natural, locomotor-enhancing compounds, for example, cod. Joint research by Taro Kishida, Professor at Ehime University and Nippon Suisan Kaisha

Ltd showed that rats fed a special diet containing 20 per cent codfish protein instead of the milk protein casein for seven days had increased muscle mass. They are now investigating the mechanisms behind the beneficial effects of this protein.

Another project led by Ken Nikawa, professor at Tokushima University, is looking at flavonoids in brown seaweed. The researchers discovered that a flavonoid called morin, found in brown seaweed, prevents muscle atrophy. This finding could also have environmental benefits as currently large amounts of seaweed are discarded as industrial waste during food processing.

Shinji Miura, Professor at the University of Shizuoka, and colleagues reported that tomatine, which is found in the skins, leaves, roots and unripened fruit of tomatoes,

increases the protein synthesis rate, leading to an increase in muscle mass, in the skeletal muscle of mice. The team is now investigating an efficient way to purify aglycon tomatine (tomatidine), that is safe and effective to use, from tomato leaves and green tomatoes.

Olives are another potential functional food source. Maslinic acid in olives and pomace (the pulp remaining after oil is extracted) is known to help control inflammation. Currently, the country's largest olive production is in Kagawa prefecture, where production increased from 66 tonnes to 383 tonnes between 2000 and 2014, but there is no effective use for the pomace. So Nippon Flour Mills Co. Ltd. has decided to use the waste material in a number of new products.

The company has developed an extraction method for maslinic acid and introduced

a product known as Olive Fruit Extract that contains 10 per cent maslinic acid and 15 per cent other olive fruit components. However, since the data for the health effects on humans are still being accumulated, these products are not yet labelled as functional foods, says Kazuhiko Aida, vice manager of Nippon Flour Mills Innovation Center.

In the near future, the company plans to develop functional foods with maslinic acid that could prevent locomotive syndrome (a condition of weakened mobility), extend healthy life expectancy while, at the same time, helping to revitalise the region's agricultural sector. ■



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