SPOTLIGHT ON

FOOD SCIENCE IN JAPAN

The content in this reprint was originally published in Nature, Vol 534, No 7606, June 9, 2016
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Located next to Tokyo, Kanagawa prefecture is home to 9 million people. It is one of the fastest grey-ing prefectures in Japan, which in turn is the fastest ageing country in the world. In 1970, relatively few in the prefecture were aged 80 or over, but this age group is predicted to become the largest in Kanagawa by 2050.

As people age, they tend to alter their eating habits and become less active. Such changes raise the risk of lifestyle-related diseases, increase the burden on the nursing care system and curtail life expectancy. “We won’t be able to maintain the current social welfare system by the time this large cohort of older people become sick and need hospital treatment under the national health insurance system,” warns prefectural governor, Yuji Kuroiwa. “To overcome such unprecedented changes in social structure, we have to seize the initiative now. The keyword is ME-BYO.”

A new concept of health
By introducing the concept of ME-BYO — in which a person’s health is viewed on a sliding scale between perfect health and sickness — to everyday life and encouraging its citizens to maintain their health, Kanagawa aims to promote healthy ageing as well as create new cutting-edge medical markets and innovative healthcare industries.

“Since everyone is somewhere on the ME-BYO scale, everybody needs to work on improving their health,” says Kuroiwa. “For example, most people are not suddenly diagnosed as having full-blown dementia. In the ME-BYO concept, risk factors and symptoms of dementia are detected in the early stages. Thus, by discovering where you lie on the ME-BYO scale, the progress of disease can be delayed by eating healthy food, exercising and doing mental puzzles.”

“The concept of improving ME-BYO is also effective for the sick,” Kuroiwa adds, relating his own experience with his father who was diagnosed with liver cancer and informed he had two months to live. But after altering his lifestyle based on the advice of a Chinese medicine doctor, he lived for another few years.

“Some say the concept of ME-BYO is the same as disease prevention,” Kuroiwa says. “But being either healthy or sick is a concept promoted by medical treatment providers. In reality, there’s no clear-cut distinction between the two states. For the sick, the option of prevention no longer exists. And even if you are in good health, it doesn’t mean you are completely healthy. In the ME-BYO concept, the ME-BYO level varies on a continuous scale between the two states.”

ME-BYO innovations
It is already possible to gauge your ME-BYO state by using smartphones or wearable devices with built-in sensors that measure parameters such as heart rate, blood pressure and tone of voice. In the future, household furniture and appliances such as toilets and beds will be equipped with sensors that can collect data, analyse your ME-BYO state and dispense advice. Kanagawa is developing a system that will enable people to check where they are on the ME-BYO scale using cutting-edge technologies such as big data and artificial intelligence.
Kanagawa runs healthcare programmes in cooperation with the municipal governments, local communities and companies. For example, the prefecture has designated its western regions, such as Odawara and Hakone, as ideal locations for improving ME-BYO since people can benefit from their natural environments, hot springs and agricultural and fishery products. Under the programme, Kanagawa has set up several points where people can perform daily ME-BYO check-ups using monitoring devices, create their own ME-BYO clinical records and do activities that improve their ME-BYO.

Also, new industries are emerging as companies enter the ME-BYO market. Kanagawa has been trying to create ME-BYO industries that optimize a person’s mental and physical condition by providing products and services that improve ME-BYO and hence lead to a healthier life.

Kanagawa is encouraging research, development and marketing of companies in the prefecture by setting up three special industrial zones recognized by the national government — a life science industry zone, a robotics industry zone and a national strategic special zone. It also plans to establish a centre to educate healthcare and medical human resources to global standards. In addition, it has set up a research centre to promote the industrialization of regenerative medicine and cell therapy.

Moreover, Kanagawa has taken global initiatives to spread the ME-BYO concept, signing memoranda with overseas authorities, including the states of Maryland and Massachusetts and Stanford University.

To advance international cooperation, Kanagawa hosted an international conference, ME-BYO Summit Kanagawa 2015, in Hakone last October. At this conference, about 200 people from all over the world, including from the World Health Organization, the National Institute of Health (US) and the National University of Singapore, discussed the design of a new social system based on the ME-BYO concept. The prefecture plans to hold this summit once every two years.

The critical role of food
Kanagawa is looking for scientific evidence that shows food is a key factor for maintaining good health in ME-BYO projects. One project, which has been running since 2008, is seeking to develop methods to assess food functionality. This will assist people to maintain their health and delay the onset of lifestyle diseases associated with ageing. It will also provide fresh impetus to the food industry.

“We’re building a public system for assessing food functionality and safety based on nutrigenomics,” says Keiko Abe, a professor at the University of Tokyo and project leader. “The project adopts a scientific approach to the evidence-based analysis of the effect and efficacy of functional foods for health and anti-ageing. As Japan is greying, our mission is to find healthy ingredients, develop functional foods to maintain wellness and find ways to delay the onset of lifestyle diseases associated with ageing.”

For example, Abe’s team has shown that polyphenols in maple syrup are effective for fighting obesity and diabetes in mice, since they inhibited inflammatory reactions in the liver after the mice were fed a high-fat diet. The team is collaborating with major food companies to conduct case studies of functional analysis by nutrigenomics and to develop health products.

It is also important to ensure food safety. The safety of carcinogens in chemical substances such as food additives is checked by an analysis method developed by Kanagawa Prefectural Institute of Public Health that uses Bhas 42 cells. The institute established the method based on basic research conducted over the past 20 years.

“Analysis methods for detecting genotoxicity of carcinogens in chemical substances during the tumour initiation phase currently in study,” explains Kiyomi Ohmori from Kanagawa Prefectural Institute of Public Health. “However, no officially recognized method existed to detect non-genotoxic carcinogens likely to be tumour promoters that do not use test animals to evaluate the promotion phase of carcinogenic substances. Thus, the development of a reliable and appropriate screening method to detect tumour promoters was a global need. Everyone is in the ME-BYO state for tumour initiation. Since tumours grow gradually with a promoter, it’s vital to find out what compounds are promoters and what compounds prevent tumours from forming in the human body.”

Bhas 42 cell transformation assay can detect tumour promoters and tumour initiators by varying the treatment conditions with test chemicals. The carcinogenic analysis method was officially recognized as an international standard method for predicting carcinogenicity by the Organisation for Economic Co-operation and Development (OECD) in 2016. This method will also benefit the development of ME-BYO industries, by helping to reduce animal testing during drug discovery and development. Ohmori’s team is analysing the method’s mechanism so that it can be added to the test guidelines of OECD regulations.

Through its ME-BYO projects, Kanagawa Prefectural Government aims to help solve the challenges caused by a super-aged society and build a new model to overcome the rapid social changes. “Everyone, including citizens, governments and medical organizations, will be happy under the new healthcare system. We want to obtain evidence to show that the ME-BYO approach can extend healthy life expectancy,” Kuroiwa says.

What is ME-BYO?
ME-BYO is the state between health and sickness

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<th>Healthy</th>
<th>ME-BYO</th>
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As one initiative by Kanagawa Prefectural Government based on the new concept of ME-BYO, Kanagawa University of Human Services aims to enhance the quality of life through promoting functional foods and strengthening individual-based nutritional care.

The long life expectancy of Japanese people is due in no small part to their nutritionally balanced diets. So it might come as surprise that the Japanese diet has not always been as healthy as it is today. Throughout its history, Japan has tackled various dietary issues — ranging from nutritional deficiency to overeating — to improve the health profile of its population.

In recent years, however, the country has been confronting new dietary challenges. “Double burden malnutrition describes the situation where both excessive and low nutrition coexist within the same population,” says President Teiji Nakamura of Kanagawa University of Human Services (KUHS). “For example, middle-aged men suffer from obesity, while female adolescents, the elderly and the sick are underweight.”

He also points out that in ageing societies like Japan’s, where medical care and welfare costs are increasing, it is vital to prevent people from developing lifestyle-related conditions that require care and impose a burden on the national budget.

To address these issues, researchers at KUHS are exploring so-called functional foods. These foods are generally agricultural produce rich in beneficial compounds. For example, oranges contain β-cryptoxanthin, which prevents osteoporosis, while tea contains methylated catechin, which staves off hay fever. “By adding functional foods to the existing diet, we aim to create a new Japanese diet that will improve health at an individual level,” explains Nakamura.

As part of a project under the National Institute of Agriculture and Food Industry, the university is setting up nutrition care stations at local supermarkets and farm stalls, where dietitians provide individual consultations about daily meals and the appropriate use of functional foods based on scientific research.

**The new concept of ME-BYO**

KUHS is collaborating with Kanagawa Prefectural Government, which is aiming to become the prefecture with the longest healthy life expectancy (that is, the expected number of years for which people can live independently without care).

To achieve this goal, KUHS will draw on the concept of ME-BYO, which basically refers to the state of being in between perfect health and sickness. Thus, in this concept, the boundary between health and being illness is not well defined. This reflects the fact that the two states vary continuously throughout a person’s life. Consequently, people should constantly strive to improve their well-being, regardless of their present state of health.

Kanagawa Prefectural Government proposes that food, along with exercise and social activity, is an important element for counteracting ME-BYO. And enhancing the safety and functionalities of crops will not only increase the health benefits of the food, but also vitalize the agricultural sector.

Based on this notion, KUHS works with local farmers to produce meals containing functional foods at local restaurants and canteens while collecting data on...
Building a healthy diet
As noted above, the Japanese have not always eaten as well as they do today. Traditional Japanese cuisine relied heavily on rice and lacked sources of protein, fat, vitamins and minerals, leading to pandemics due to severe nutritional deficiencies.

The early stages of nutrition and dietetics research in Japan led to the discovery of vitamin B1 and the establishment of the country’s first nutritional research institute and dietitian training school in the 1920s. But it was only after the Second World War that malnutrition was gradually overcome. Western foods such as wheat flour and skimmed milk were introduced at schools and hospitals, and dietitians played a vital role in educating the public on food and nutrition.

“It was not only good food distribution but also dietary education that improved the nutritional state of the Japanese people,” Nakamura points out.

The westernization of Japanese meals, however, led to the emergence of obesity, diabetes and other chronic diseases. In response, the government shifted the focus of its nutritional policies from treating these conditions to preventing them.

“From 1990 onwards, nutritional education focused on preventing lifestyle-related conditions and addressing the general public, whereas it has been targeting individuals and specific groups from 2008,” says Nakamura. “Therefore, a healthy Japanese diet was established by combating both low and excessive nutrition. These effective nutritional policies significantly contributed to Japan having the world’s longest life expectancy.”

Nurturing dietitians in Asia
The benefits of Japan’s dietary resources are now overflowing its borders. In 2013, Hanoi Medical University opened Vietnam’s first dietetics education and training course, supported by a collaboration between academia (Vietnam National Institute of Nutrition, Jumonji University, KUHS and Japan Dietetic Association), Japanese food industry (Ajinomoto Co., Inc.) and government (JICA and Kanagawa prefecture). KUHS is currently providing teachers for the course. In January 2016, it organized a training trip for teachers at Hanoi Medical University to visit KUHS, hospitals, care homes and schools in Kanagawa prefecture. The university will also provide various other forms of assistance, including training Vietnamese teachers in clinical nutrition, developing criteria for stationing dietitians and standardizing dietitians’ work.

“If the partnership with Hanoi Medical University is successful, we are planning to expand it to other areas of Vietnam as well as neighbouring countries such as Cambodia, Myanmar and Laos,” says Nakamura. “With a long history of improving nutrition, we have a duty to assist other Asian countries.”

The future of nutrition and dietetics
From community-based work to supporting education and training in Asia, KUHS is leading modern advances in nutrition and dietetics at home and abroad.

Established in 2003, KUHS is a new public university and provides specialist programmes in nursing, nutrition and dietetics, social work, and rehabilitation, which are designed to nurture specialists who can assist in the fields of health, medical care and social welfare. This will enable them to become professionals who can provide holistic human services, reflecting the university’s philosophy.

“In recent years, people around the world are gradually shifting from desiring a long life expectancy to wanting a long healthy life expectancy,” says Nakamura. “How we respond to this shift is a question for future dietetics and nutrition studies. We are exploring how to optimize nutrients and food by researching nutrients and developing a new diet. And we want to communicate the results globally.”

Our location
Kanagawa University of Human Services is located on the western arm of Tokyo Bay. It is about half an hour by train from the lively metropolis of Yokohama and is not far from Kamakura, the shogunate capital during the Kamakura period (1185–1333). A bit further afield is Mount Fuji, which is 3,776 metres high.

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