

Thematic Article

History and characteristics of Okinawan longevity food

Hiroko Sho Director

University of The Air Okinawa Study Center, Okinawa, Japan

Okinawan food culture in the Ryukyu island is one of the world's most interesting culture because its consumers have the longest life expectancies and low disability rates. It is a product of cultural synthesis, with a core of Chinese food culture, inputs through food trade with South-East Asia and the Pacific and strong Japanese influences in eating style and presentation. The Satsamu sweet potato provides the largest part of the energy intake (and contributes to self-sufficiency), there is a wide array of plant foods including seaweed (especially konbu) and soy, and of herbaceous plants, accompanied by fish and pork, and by green tea and kohencha tea. Infusing multiple foodstuff and drinking the broth is characteristic. Raw sugar is eaten. The concept that 'food is medicine' and a high regard accorded medical practice are also intrinsic of Okinawan culture. Again, food-centered and ancestral festivities keep the health dimensions well-developed. Pork, konbu and tofu (soy bean-curd) are indispensable ingredients in festival menus, and the combination of tofu and seaweed are used everyday. Okinawan food culture is intimately linked with an enduring belief of the system and highly developed social structure and network.

Key words: festivals, fish, foods, history, Japan, konbu, longevity, Okinawa, pork, raw sugar, Ryukyus, sweet potato, soy, tofu.

History of Okinawan Cuisine

Okinawan cuisine has developed under the influence of a number of factors, including the geographical and historical background of the Okinawan people and their attitude to food.

If we place the point of a compass on Okinawa, and draw a circle with a radius of 2500 km, which is the distance to Hokkaido (Fig. 1), we find that Okinawa occupies an extremely important position in the arc of the Japanese archipelago. In the north lies the main islands of Japan and the Korean Peninsula, to the west is continental China and to the south are the countries of South-East Asia, from Taiwan through to Thailand and Vietnam. The Okinawan geographical environment is unique and is only seen in a few parts of the world, with islands that are subtropical in nature, however with the surrounding ocean tropical.

Historically, relations with China go back the furthest, with mention of the Ryukyu islands appearing in Chinese history texts dating back to 605 AD, corresponding to the Japanese Asuka Period and the Chinese Sui Dynasty. The ensuing Tang Dynasty, established by Li En, exerted a strong influence on the rest of Asia in the fields of 'Culture and Institutions'. From that time, the people of the Ryukyus have known China by the name 'Toh' (the way the local and other Japanese people read the character 'Tang').¹ Envoys of the Chinese Emperor began to visit the Ryukyu kingdoms from the 14th century. From the beginning of the 15th century, special envoys were sent to legitimise the enthronement of new Ryukyu kings in the Sappo investiture ceremony.² Records indicate that the Sappo envoys were entertained at a series of seven banquets. The envoys from the Chinese emperor were sometimes 500 and they remained in the capital Shuri as guests of the court for 6 months, making their entertainment a major enterprise for the entire kingdom. For this reason, chefs were sent to China to study.

In the 17th century, Okinawa was annexed by the Satsuma clan from southern Japan. Satsuma officials were stationed in Okinawa to oversee the puppet Ryukyu Kingdom government. To entertain these officials, cooks were sent to mainland Japan to learn the Yamato cuisine. As a result, an unique Ryukyu 'Court Cuisine' for special occasions which incorporated influences from Chinese and Yamato cuisines developed, centred on the court at Shuri.^{5,6}

In contrast to these elaborate cuisines, a *commoners' cuisine*, also unique to Okinawa, grew under similar historical influences, also putting to use knowledge gained through trade with South-East Asian countries, and incorporating local traditions setting out how to best use the local produce. This has been handed down as the traditional Okinawan 'healthy diet'. These various cuisines can be considered to be truly unique and at the same time truly international.

Everyday diets in the Meiji and Taisho eras

The oldest existing public record of Japanese everyday diets is the 'Survey of Japanese People's Diets', as shown in Fig. 2. This was prepared in the twelfth year of the Meiji era (1880) by the then Department of Agriculture and Commerce. In this report is included a 'Comparison of Food Types in People's Diets' covering 78 districts and clan fiefdoms from Ishikari and Hidaka in the north to the Ryukyus in the south. We chose 15 districts from the total to provide a comparison with the Ryukyus.⁵

Correspondence address: Professor Hiroko Sho, Director, The University of The Air Okinawa Study Center, 1 Senbaru, Nishihara-cho, Okinawa 903-0129, Japan. Tel: +81 98 895 5952; Fax: +81 98 895 5953
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Figure 1. The position of Okinawa.

According to this report, sweet potato made up some 93% of the everyday diet in the Ryukyu fiefdom, considerably more than any other region. In Japan, this type of sweet potato is known as the Satsuma sweet potato. In the Ryukyus, this sweet potato was consumed four times as much as in Satsuma, and it was without doubt the staple food. Meals consisted of ‘sweet potato and miso soup with plenty of vegetables’ for breakfast, lunch and dinner, and between meals or snack might be steamed sweet potato. As shown in Table 1, this dietary pattern persisted until the Taisho Era.⁶ If we compare the nutritional content of steamed sweet potato and boiled white rice, we find that rice contains more energy-giving protein, fat and carbohydrates than sweet potato, with 23 kcal more energy per 100 g. Sweet potato contains more fibre, minerals and considerably more calcium, potassium and vitamins (B1, B2 and C). This made the sweet potato a vitally important staple food at the time, when there was less variety of foods available compared to the present.⁷

If we consider the agricultural methods of the time, the energy yield from the amount harvested per unit area was much better for the sweet potato than for rice. Disregarding the storage problem, the sweet potato was the ideal staple food from a self-sufficiency point of view. In particular, farmers were obtaining an average of 700 mg/day of Vitamin C

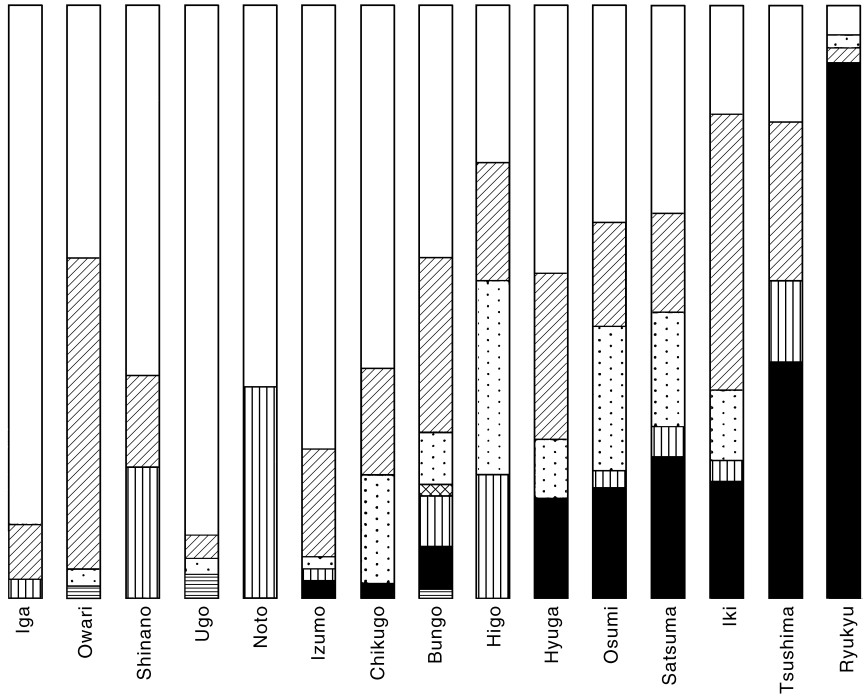


Figure 2. Survey of Japanese people's diets (1879, twelfth year of Meiji era). (■), sweet potato; (▨), minor grains; (▤), wheat; (▥), millet, (▧), barnyard grains; (▩), sugar-beet; (□), rice.

Table 1. Survey of everyday diet of Okinawan people (1919, eighth year of Taisho era)

Class	Energy (kcal)	Protein (g)	Fat (g)	Carbohydrates (g)	Notes
A	2395	42.4 (7.1)	4.4 (1.7)	546 (91.2)	White rice 3~6 bowls (420~840 g) Sweet potato 1~2 serves (600~1200 g)
B	2868	38.0 (5.3)	5.1 (1.6)	668 (93.1)	White rice/millet 1~2 bowls (140~280 g) Sweet potato 3~6 serves (1800~3600 g)
C	3650	39.0 (4.3)	5.8 (1.4)	860 (94.3)	Sweet potato 4.5~8 serves (2700~4800 g)

Figures in parentheses indicates percentage of total energy intake. A, teachers, public officials, etc; B, part-time farmers; C, full-time farmers.

per person form their staple food. If we take into account the radish and sweet potato leaves and other green vegetables found in their miso soup, we find they ate 'longevity food, plain but rich in vitamins, minerals and fibre'.

In addition, some form of festival occurred nearly every month and although there were local variations, consumption of animal protein in the form of fish, pork or goat was always a feature, helping build stamina and resistance to disease.

Okinawan red sweet potatoes are well-known throughout Japan as having a high polyphenol content. Deep yellow varieties include the Okinawa no. 100, the Ajimasari, and the Sakiyama Benii, and others have high levels of anthocyanin pigments. The various types of sweet potato all have high levels of anti-oxidants and have long formed the staple diet of the people of Okinawa.

The culture of Okinawan longevity food

As previously described, the longevity food culture of Okinawa has developed in its unique fashion through clever adaptation of knowledge received from the Japanese mainland and South-East Asian countries, with the strongest influence from China. Some other major factors to influence

the development of this longevity food culture are the indigenous Okinawan religious practice of 'ancestor worship'⁴ and the concept from Chinese herbal medicine of 'food as medicine'.⁸

The people of Okinawa honour their ancestors and express their gratitude in various ways to the ancestral spirits. Evidence of this can be seen in Table 2, where approximately 60% of the annual events in Okinawa are festivals for the ancestral spirits.⁸ The foods consumed at these festivals vary from district to district, but they usually include animal proteins not normally available, such as pork, fish and fish paste. As well as having an important influence on Okinawan food culture, as shown in Fig. 3¹⁰ the nutritional values of these festival foods also played a part in the longevity of the Okinawan people.

The attitude of the Okinawans to their food is unique and from antiquity their everyday diet has contained a number of elements with medicinal qualities connected with longevity. This is because Okinawa is composed of small subtropical islands, with a harsh environment often subject to droughts and typhoons from ancient times. Particularly in the outlying islands, a great deal of ingenuity was needed just to survive.

In ancient Chinese texts where the ranking of doctors was outlined, the highest ranking was the diet doctor, followed by the internal medicine doctor, the surgical medicine doctor and the veterinarian doctor. This indicates that the doctor who supervised dietary therapies was more respected than the physician or surgeon and shows us just how much importance the ancient Chinese attached to their diet. The long-lived people of Okinawa, strongly influenced by China, also believe that 'food maketh the man', and believe that the food they eat is 'nuchi gusui', or 'medicine for life'. Even now, when we hold interviews with our centenarians, they always prepare their favourite meals and without fail explain its healthy properties to us. The Okinawan 'longevity food' is therefore the 'good for the health' food that the long-lived people are eating in their usual meals every day.

Table 2. Main Okinawan festivals

Date	Name of Festival
Festivals for ancestral spirits	
1~2 January	New Year
7 January	Feast of Seven Herbs of Health
16 January	New Year of the Dead
20 January	Old New Year
February	Old Spring Equinox
March	Seimeisai
5 May	Boy's Day
7 July	Star Festival
13~15 July	Festival of the Dead (Obon)
August	Old Autumn Equinox
9 September	Chrysanthemum Wine
30 December	End of the Year
Agricultural festivals	
3 January	First Day of Work
15 February	Wheat Ear Festival
15 March	Wheat Harvest Festival
15 April	Levee Making
15 May	Rice Ear Festival
15 June	Rice Harvest Festival
25 June	Kashichi Orime
9 August	Kashichi Orime
15 August	Moon Festival
November	Sweet Potato Festival
Festivals for Warding Off Evil Spirits	
February	Shima Kusarashi
3 March	Girl's Day
10 August	Shiba Sashi
11 August	Yoka-bi
8 December	Oni Mochi
Festivals of Foreign Gods	
4 January	Visit of Kitchen God
4 May	Haryu-sen
July	Sea God
24 December	Ogantoki

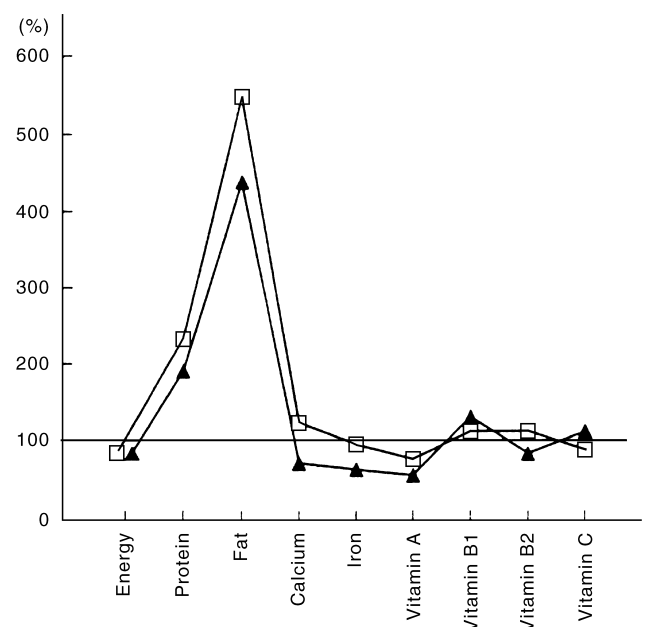


Figure 3. Comparison of levels of nutrients consumed at festivals and in everyday diet. (□), traditional festival food; (▲), local festival food.

Characteristics of the longevity food of Okinawa

As previously mentioned, Okinawan longevity food has been strongly influenced by Chinese ideas of longevity through diet. Evidence of this lies in the terms used to express the effects of Okinawan longevity food, that closely resemble those found in the Chinese 'Honzosho', a herbal medicine textbook. For instance, the Okinawan dialect terms *ujini* (supplement) and *kunchi* (spirit) correspond to the Chinese *hochuekiki* (supplement homeostasis). Similarly, *hassan* (the fever ceases by the reaction of sweating) medicine (food for a radiative illness) corresponds to the Chinese herbal medicine concepts of 'respiratory infection with fever illness' and 'respiratory infection with fever food'. These concepts still exist in Okinawa.

The only surviving dietary herbal medicine text in the Ryukyu tradition is the 'Gozen Honzou'¹¹, written by Tokashiki Tsukan, the chief court physician to the Ryukyu royal family. An essay published in August 1961 for the purpose of preserving and dissemination of historical cultural treasures is 'Gozen Honzo,' a priceless dietary text written 100 years ago by the renowned physician to the Shuri court, Tokashiki Pechin Tsukan. Dr Tokashiki was greatly trusted by the then king, King Shoukou, and was appointed chief court physician. He was sent off to study in far-off Beijing in January of the twelfth year of the Doukou Era. There he mastered dietary medicine under the tutelage of Chou Eishin, medical director of the Beijing University Hospital, and great physician of the reign of the Senshuu Emperor. His writings tell us that illnesses come from the spirit, so we first look for the source of the illness and the organ it is affecting. In the majority of cases, treatment is entirely through food and drink, and if we 'nourish the spirit, the illness will cure itself'. This Honzousho, presented to the court in 1832, comprised 19 chapters, listed the Chinese and local names for 303 dietary ingredients, and their pharmacological properties, combinations and therapeutic uses.

There are three main characteristics of Okinawan longevity food.¹² The first is *shingi gusui*, or 'infused medicine', which means a concoction of the foodstuff as an herbal medicine. This is not just one ingredient at a time, but a combination of several, infused together with great attention to the order and combination. This combining is the second characteristic, the most widely used to this day being *chimu* and *shinji*, a concoction of pig's liver and vegetables such as island carrot or garlic, the broth of which is given to people when they are sick. Many believe even now that this is effective against all illnesses and this makes some sense from the nutritional point of view. Older people still maintain that it must be made with the long thin yellow island carrot. Another often used combination is of a freshwater fish such as *kuiyu* (carp) and *taiyu* (bream), and *nigana* (a bitter vegetable), infused together and said to be effective as an antipyretic, for recovery from fatigue, bringing on lactation and as a nutritional supplement.¹³ Packages of carp and *nigana* are sold in the Okinawan public markets and they become hard to get when colds and influenza are common.

The system of infusing not just one, but multiple foodstuffs together and drinking the resulting broth is important from the point of view of the additive and interactive effects of the various nutritional and trace elements. An excellent feature of longevity food lies in the fact that, particularly in

the past when nutrition was poor, they aimed for a combination of medicinal effect and nutritional supplementation, with trace elements and protein for amino acid supplementation.

The third main characteristic is that Okinawan longevity food does not utilise herbal medicines which are found in a Chinese medicine dispensary, but rather uses combinations of foodstuffs found very close to hand and incorporates them into the everyday diet. For instance, *ichouba* (fennel, effective as an antitussive and a perspirant in colds, and as a stomachic) is used to take away the smell from fish soup. *Choumigusa* (long-life grass, effective against paralysis and hypertension, and as an antipyretic in colds) is eaten as an accompaniment to sashimi (raw fish) and there are many more examples. The main aim is to build up physical strength to prevent illness, keep one's health, and further longevity through the maintenance and promotion of a healthy lifestyle.

Pork cuisine and the meat eating culture

In Okinawa, they have sayings such as, 'Eat the entire pig and leave nothing, and 'You can eat every part of a pig apart from its oink'. In other words, a feature of pork cuisine is the clever use of all the beast, including the pig's legs and feet, ears, the skin of the face, heart, kidneys, lungs and other organs. When Sasamori Gisuke, who was born in Aomori Prefecture, visited Okinawa in the twenty-sixth year of the Meiji era, he was full of praise, saying

'They say one sort of pig is enough to produce dozens of different marvellous dishes. The delicacy of the pork cuisine here would be enough to shame into silence Westerners who eat meat as their main dish'.

Pigs were first brought into the Ryukyus by Chinese immigrants in 1392, but they failed to become widespread because of a lack of food in the farms of the time.¹⁴ When sweet potatoes were introduced from Fukkien Province in China, however, the practice of pigbreeding spread rapidly, marking the beginning of the meat eating culture.

The cultivation of sweet potatoes spread from its point of origin in Mexico across the Pacific Ocean to the island of Luzon in the Philippines in 1571. It was introduced into China twice, to the Shugai region in 1578 and to the Bin region of Fukkien Province in 1594. The importance of the dissemination of sweet potato cultivation is underlined by the Binsho (Book of Bin), which states that the farmers of China were saved from famine by its introduction.¹⁵

The relationship between 'pork and sweet potato' occupies a special position in Okinawan food culture, favourable geographical conditions helping the combination to become by far the most important food items. It goes without saying that all the pig was eaten, including the fat, leaving nothing behind. This is very different compared to the Japanese mainland where a vegetarian diet for religious occasions is observed. In Okinawa, pork is even included in the dishes served at funerals.¹⁶ During a survey conducted in Itoman City in the south part of the main island of Okinawa, we learned of a way of preserving pig's blood, in essence the same as the 'paste' foods seen in western meat eating cultures.⁸ Fresh pig's blood is mixed with salt and starch, then placed in a basket lined with a cloth and steamed for about 30 min. Once the mixture sets like jelly, it is cooled and kept in a jar containing pork fat. This is an extremely simple

preserving method, but it observes the basics of flavouring with salt, adding starch as a setting agent, heating and then keeping air out. Western recipes use a variety of spices, and also make 'blood sausages'. In addition, fatty cuts such as belly pork can be salted and last a comparatively long time, even in subtropical regions with high temperatures and high humidity, again surprising us with the ingenuity of our forebears.

Some present examples of widely used Okinawan pork dishes include *leg tibichi* (soup made with leg of pork, konbu seaweed and daikon radish or gourd melon), *ear skin sashimi* (skin of the face or ear in a vinegar and miso salad with cucumber, beanshoots and peanuts), and *nakami suimono* (soup made with pig stomach or intestine, cooked with mushrooms until soft). These dishes all contain large amounts of collagen and elastin, both attracting interest in recent years as important substances in preserving health and long life through the prevention of lifestyle diseases.

From the mid-1960s until the early 1990s, in my laboratory we have conducted experiments with foodstuffs our Okinawan elders eat everyday as being 'good for the health', feeding them to white rats in freeze-dried powder form.¹⁷ In one of these experiments, we fed pigs feet, ears, stomach and intestine to hyperlipidaemic white rats and examined the

effects on lipid metabolism. The results, as shown in Tables 3 and 4, show that a statistically significant reduction in serum and hepatic triglyceride levels was seen in rats fed pigs feet. This indicates that pork cuisine is not simply a source of protein, but also has health-giving effects as a result of its collagen content. It deserves attention as an integral part of Okinawan longevity food.

We tend to avoid pork in this present era of overeating, but in Okinawa it is a major pillar of the longevity diet. It is important to realise that there is a fat content, not just in the meaty portions, but in the special parts such as feet and ears, skin of the face and internal organs, and to remove this during the preparation process. In popular dishes such as *sooki shiru* (soup made with pork ribs and daikon radish and konbu seaweed), *nakami no suimono* and *leg tibichi*, the subcutaneous fat is carefully removed in a process known as *akunuki*, so that these healthy pork dishes are made with almost no saturated fat content (Table 5).¹⁸

The highest dietary konbu consumption in Japan

The Okinawan people have always included a number of different varieties of seaweed in their everyday diet and in large amounts. *Konbu* is particularly used, which is not locally produced, nevertheless features in both traditional festival

Table 3. Effect of feeds on serum lipids

Feed	Total (mg/dL)	Free (mg/dL)	Ester (%)	Cholesterol HDL (mg/dL)	HDL (%)	Triglycerides (mg/dL)
Control	122 ± 24.5*	18 ± 3.2	85 ± 2.9	40 ± 9.0	32	68 ± 14.3
Ear	145 ± 27.6	14 ± 6.3	90 ± 1.4	38 ± 12.0	26	65 ± 16.1
Pigs feet	100 ± 25.8	14 ± 7.3	86 ± 4.7	41 ± 14.0	41	55 ± 5.3
Stomach and intestine	108 ± 12.6	11 ± 3.7	90 ± 2.4	40 ± 5.0	37	54 ± 10.0

*Mean ± SD. HDL, high-density lipoprotein.

Table 4. Effect of feeds on hepatic lipids

Feed	Total (mg/g liver weight)	Free (mg/dL)	Cholesterol Ester (%)	Triglycerides (mg/g liver weight)
Control	37 ± 2.3*	12 ± 2.6	68 ± 6.9	45 ± 12.6
Ear	52 ± 8.4	15 ± 1.4	71 ± 5.6	50 ± 12.8
Pigs feet	54 ± 9.7	12 ± 1.5	77 ± 4.0	23 ± 6.2
Stomach and intestine	43 ± 5.3	12 ± 1.1	73 ± 2.7	41 ± 5.3

*Mean ± SD.

Table 5. Energy and fat content per serving of common pork dishes before and after preparation

Name of dish	Energy (kcal)		Fat (g)	
	Before	After	Before	After
<i>Sooki shiru</i>	213	132	13.6	4.0 (29)
<i>Nakami no suimono</i>	200	99	17.2	3.8 (22)
<i>Leg tibichi</i>	349	216	23.0	10.8 (47)
<i>Inamu dotchi</i>	248	132	12.5	5.2 (42)
<i>Rafuchi</i>	790	625	60.3	52.3 (87)
<i>Mimiga sashimi</i>	162	120	9.5	5.4 (57)

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menus and in the everyday diet. This dates back to the 18th century, when raw sugar from Okinawa was traded at Shimonoseki to the Kitamaesen trading ships in return for *konbu*. This was brought down all the way from Hokkaido down to Okinawa on the ships of the so-called 'Konbu road', then used in trade with China.¹⁹ *Konbu* grows in seawater and said to contain 45 or more different elements, all being important minerals. The absorption rate has been reported to be high, and *konbu* also contains dietary fibre and essential fatty acids such as eicosapentaenoic acid (EPA) and docosa-hexaenoic acid (DHA).

Okinawan people eat tofu regularly. Consumption of large amounts of seaweed rich in sulfur-containing amino acids brings supplementary effects of amino acids and makes good dietary sense for Okinawan people, as these amino acids are lacking in soybean protein. Pork, *konbu* and tofu are indispensable ingredients in festival menus and the combination of tofu and seaweed is common in the everyday diet. Some examples include clear soup with tofu and *asa* (hitoegusa, a green seaweed), or adding fried tofu and *konbu* to a meat broth.

These features of Okinawan longevity food we have seen can be said to have anticipated many of the dietary factors now being studied worldwide for the prevention of lifestyle related diseases. We can but bow our heads in admiration to our forebears, and their wisdom in adhering to the principle that our health is in our own hands.

A rough summary of the Okinawan longevity food culture might include the following points:

1. In modern pork cuisine, unlike in the past, saturated fats are carefully removed in the process of boiling or *aku-nuki*. Clever use is made of collagen-rich pig's feet and internal organs.
2. Large amounts of various types of seaweed, rich in minerals, dietary fibre and essential fatty acids (EPA, DPA and DHA), are included in their diet.
3. Leafy vegetables and herbs that are rich in dietary fibre, chlorophyll and Vitamins A and C, are part of the everyday diet.
4. Okinawan tofu, which is receiving worldwide attention as containing isoflavones for the prevention of lifestyle related diseases, is consumed in large amounts.
5. Raw sugar is eaten in healthy snacks with tea and *kohencha* (a semifermented tea) is a popular drink.
6. Salt consumption is the lowest in Japan.
7. The diet is also rich in several other important nutrients, such as curcumin (yellowish substance found in curry powder) and anthocyanin (found in red sweet potatoes).

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