

## Thematic Article

# Implications from and for food cultures for cardiovascular diseases: Japanese food, particularly Okinawan diets

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Okinawans, who have a different ethnicity and food cultural history to other Japanese nationals, and an exceptional longevity have been studied at home and as migrant groups in Hawaii and Brazil. Biomarkers for fish and soy intake and intervention studies indicate that these foods, along with seaweed and green vegetables are candidates for chronic non-communicable disease prevention.

**Key words:** biomarkers, Brazil, cancer, cardiovascular disease, dementia, fish, Hawaii, seaweed, soy, WHO-CARDIAC Study.

## Introduction

Among the Japanese, whose average life expectancies in males (77.10) and females (83.99) are the longest in the world, Okinawans, particularly females, are now enjoying the longest average life expectancy (85.08) in Japan and thus in the world. A recent WHO report indicates also that Japanese disability adjusted life years (DALY), 74.5 on average, are the longest in the world. As average life expectancies are inversely related to age-adjusted mortality rates of coronary heart disease (CHD), stroke and all-cancers in the populations of developed countries, the Okinawan longevity (as well as those of Japanese) can be ascribed to their low CHD and all-cancer mortality rates. Since 1983, we have engaged in the WHO-Coordinated Cardiovascular Diseases and Alimentary Comparison (CARDIAC) study of 60 communities in 25 countries in the world.<sup>1–3</sup> One of the aims of this study is to understand the relationship between Okinawan diet and health longevity, based on analyses of biological markers of dietary intakes and cardiovascular disease (CVD, Fig. 1).

## WHO-CARDIAC study

This study has successfully demonstrated that the CHD mortality rates are positively related to serum cholesterol (Cho) levels and inversely related to 24-hour urinary (24 hr) taurine excretions. The proportion of n-3 fatty acids in plasma phospholipids, an index of sea food consumption, as well as 24 hr isoflavone excretions, a marker of soy product intake. However, stroke mortality is positively related to 24 hr Na excretions and Na/K ratios, and was inversely related to serum Cho concentrations (Fig. 2).

The Okinawan risk factors for stroke were low because of their lower 24 hr Na excretion. Okinawans have the lowest NaCl intake, at 8 g a day in Japan. Their lower CVD mortality rates were, in addition attributed to the medium range serum Cho levels (180–200 mg/100mL on average) keeping both stroke and CHD mortalities lowest. The marked soy bean consumption and appropriate fish intake was also

proven by the biological markers of these dietary intakes in 24 hr samples and blood (Fig. 2). A similar pattern, however, regarding breast cancer shows the incidence of 24 hr isoflavonoid excretion (Fig. 3).

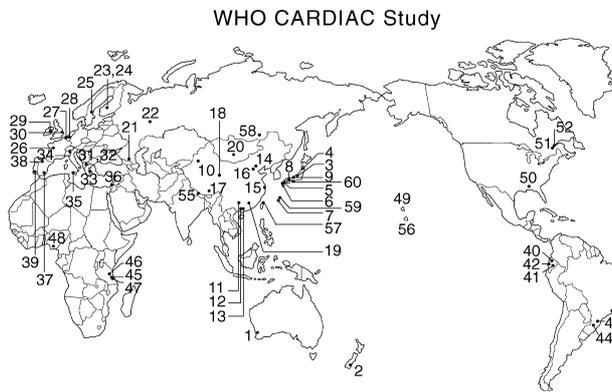
## Immigrant study on Okinawans in Hawaii and Brazil

Of three Okinawan populations, living in Okinawa, Hawaii and Brazil, those in Hawaii attain the best life expectancies of the Japanese. In the early 1980s, they were the top long-living population in the world. A cross-sectional comparative study of immigrants with age-matched elderly living in Japan by the WHO-CARDIAC study demonstrated a lower prevalence of dementia. This was attributed to nutritional factors preventive against stroke and cerebrovascular dementia, such as lower salt intake (6 g a day) and higher serum protein level. This also supported the importance of low salt intake and the traditional intake of soy products in the prevention of stroke and osteoporosis.<sup>4</sup> However, compared with Okinawans living in Okinawa and Japanese immigrants in Hawaii, Japanese immigrants in Brazil consume excessive salt and animal fat. The prevalences of hypertension, hypercholesterolemia, obesity and hyperglycemia (tendency to develop diabetes) are increased in the immigrants living in Campo Grande, Brazil compared with Japanese populations living in Japan.

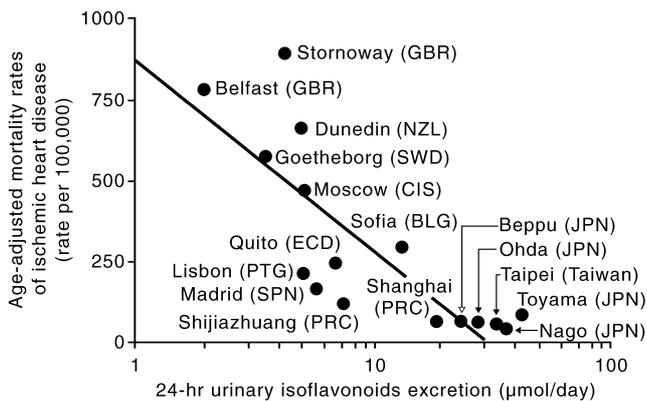
## Intervention study

People of Japanese ancestry in Brazil, 10 males and 10 females aged between 47–57 with a high risk of CVD, were studied. They were given 3 g of docosahexaenoic acid (DHA) daily

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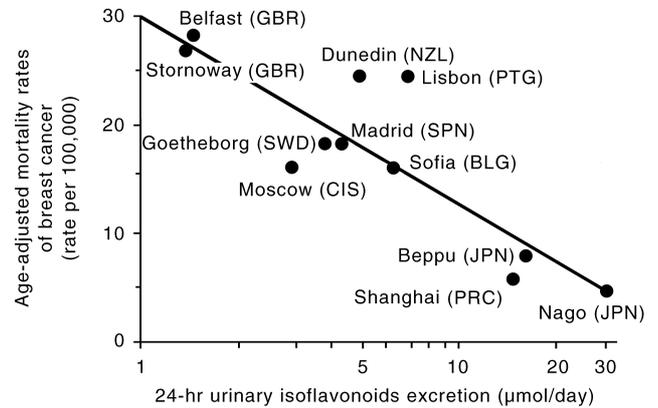


**Figure 1.** WHO-Cardiac study populations in the world. 1. Australia (Perth) 2. New Zealand (Dunedin) 3. Japan (Toyama) 4. Japan (Hirosaki) 5. Japan (Beppul) 6. Japan (Kurume) 7. Japan (Okinawa) 8. Japan (Hiroshima) 9. Japan (Ohida) 10. China (Urumqi) 11. China (Guiyang) 12. China (Guangzhou) 13. China 14. China (Beijing) 15. China (Shanghai) 16. China (Shijiazhuang) 17. China (Lhasa) 18. China (Altai) 19. China (Hetian) 20. China (Tututan) 21. Georgia (Tbilisi) 22. Russia (Moscow) 23. Finland (Kupio) 24. Finland 25. Sweden (Goetheborg) 26. France (Orleans) 27. Belgium (Leuven) 28. Belgium (Ghent) 29. UK (Belfast) 30. UK (Stornoway) 31. Bulgaria (Sofia) 32. Bulgaria 33. Greece (Athens) 34. Italy (Milan) 35. Italy (Palmero) 36. Israel (Tel Aviv) 37. Spain (Navas) 38. Spain (Madrid) 39. Portugal (Lisbon) 40. Ecuador (Quito) 41. Ecuador (Viravamba) 42. Ecuador (Manta) 43. Brazil (Uruguiana) 44. Brazil (Beje) 45. Tanzania (Handeni) 46. Tanzania (Shinya) 47. Tanzania (Dar es Salaam) 48. Nigeria (Ibadan) 49. USA (Honolulu) 50. USA (Jackson) 51. Canada (St John) 52. Canada (Montreal) 53. Brazil (Sao Paulo) 54. Brazil (Campo Grande) 55. Nepal (Nanche Bazar) 56. USA (Hilo) 57. China (Taipei) 58. China (Huaxi) 59. Japan (Nago) 60. Japan (Amino)



**Figure 2.** Relationship between 24-hour urinary isoflavone excretion and age-adjusted mortality rates of coronary heart disease.

and showed a significant reduction in blood pressure (BP). The same people, given 5 g of seaweed powder daily, showed a significant reduction of serum Cho. Twenty females aged 47–57, given 50 mg of soy isoflavones daily, showed a significant reduction in BP, Cho, 24 hr pyridinoline and deoxypyridinoline, the latter two being markers of Ca resorption from the bone. As risk factors in Japanese immigrants were beneficially affected within 3–10 weeks by nutrients from fish, seaweed and soybean common in Japanese, particularly Okinawan diets, this approach should reduce the risk of CVD and osteoporosis can be expected to be prevented by these nutritional factors.



**Figure 3.** Relationship between 24-hour urinary isoflavone excretion and age-adjusted mortality rates of breast cancer.

### Okinawan diets and cancer

The mortality rate of stomach cancer among Okinawans is the lowest in Japan. This is because the Okinawan diet is related to a low Na intake. The lower mortalities from prostate, breast and all-cancers in Okinawans are inversely related to 24 hr isoflavone excretions in the WHO-CARDIAC study populations (Fig. 3).<sup>4</sup> Okinawan diets (especially popular soy bean dishes) are rich in isoflavones, may play a role in cancer prevention mechanisms, the mechanisms include weak estrogenic activity, estrogen receptor-blocking activity or the inhibition of angiogenesis.

### Conclusion

Healthy ageing in Okinawa can be attributed to low CHD and cancer mortalities, as a result of the Okinawan diet, characterized with low salt, soy beans, fish, seaweed and probably also green vegetables.

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