

# 10 *Impacts of modernization and transnationalism on nutritional health of Cook Islanders*

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## Introduction

As elsewhere in the Pacific, the population of the Cook Islands is characterized by the rapid increase of obesity, hypertension and type 2 diabetes, as well as profound out-migration across the past 40 years or so. Cook Islander migrations to New Zealand, and subsequently Australia, began in the 1950s, but have proceeded at such a rate that Cook Islander migrants now outnumber indigenes on the Cook Islands by about two to one (Ulijaszek 2005). The effects of economic modernization on blood pressure, body fatness and type 2 diabetes have been largely attributed to commonly measured risk factors, including dietary change associated with increased penetration of the world food system, and reduced physical activity associated with increased mechanization of life. Highly palatable and energy-dense foods are available, affordable and widely consumed in the Cook Islands (Ulijaszek 2002), and explanations invoking dietary change (Ulijaszek 2001a, 2002) and reductions in physical activity (Evans and Prior 1969; Ulijaszek 2001b) have been put forward for the high prevalence rates of obesity there.

In this chapter, trends in blood pressure, body size and diabetes status across recent decades are described for adult Cook Islanders living on Rarotonga, the most economically developed of the Cook Islands. Relationships between their blood pressure, body mass index (BMI) and fasting blood glucose are also described. These are then related to their diet, physical activity and different modernization factors in multiple regression models. In addition, blood pressure, BMI, blood pressure and fasting blood glucose of Cook Islanders living in Melbourne, Australia, are compared with their counterparts on Rarotonga.

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### Cook Islander populations

The population of the Cook Islands increased steadily across the first half of the twentieth century after a population collapse in the mid nineteenth century (Beaglehole 1957) soon after colonization by the British. There has been little increase in population between 1950 and the year 2000 (National Statistical Office 2001), despite there having been a dramatic decline in crude death rate and infant mortality rate since 1962 (Table 10.1). Migrants to New Zealand were few prior to 1950, with the number of Cook Islanders in that country being 103 in 1936, and around a thousand in 1951 (Beaglehole 1957). An estimate of emigrants from the Cook Islands, based on known resident population and population in excess of replacement level calculated from total fertility rates of 7.3 in 1955 and 3.3 in 1991 (assuming a linear decline across this period), suggests that by the year 2000, emigrants are likely to have outnumbered those born by at least two to one (Fig. 10.1). The emigrant values exclude those born in New Zealand and Australia, and are therefore smaller than the numbers given for those resident in those two countries in Fig. 10.2.

The vast majority of Cook Islander migrants live in New Zealand and Australia; however, migration to the latter country became numerically important only from the 1980s onward. Figure 10.2 shows the Cook Islander populations of New Zealand and Australia between 1986 and 2001; these are aggregate numbers of Cook Islanders both born in those countries and who are immigrants (New Zealand Census 1996; Australian Bureau of Statistics 2002). It is likely that remittances from relatives in these countries have provided much of the economic basis for the purchase of imported foods by the general Cook Islander population since the 1950s. Various accounts obtained from elderly subjects during fieldwork recalled to me in 1996 indicate that quite significant sums are remitted from

Table 10.1. *Demographic indicators, Cook Islands, 1962–2000*

	Crude death rate (/1000 population)	Infant mortality rate (/1000 population)	Proportional mortality indicator (deaths over the age of 50 years/all deaths)
1962	8.3	48	39
1982	6.5	21	68
2000	7.9	19	68
2004	7.3	17	

Source: Katoh (1988); World Bank (2001); Cook Islands Statistics Office (2006c).

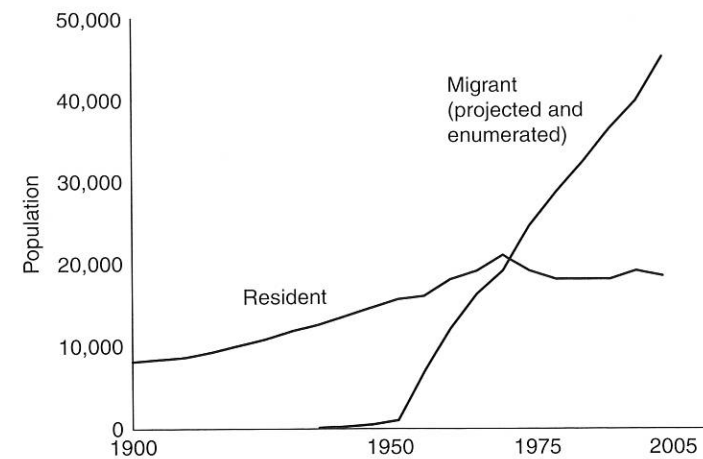


Fig. 10.1. The Cook Islander population, 1900–2005 (from Beaglehole 1957; National Statistical Office 1996, 2001; Cook Islands Statistics Office 2006c; Statistics New Zealand 2006).

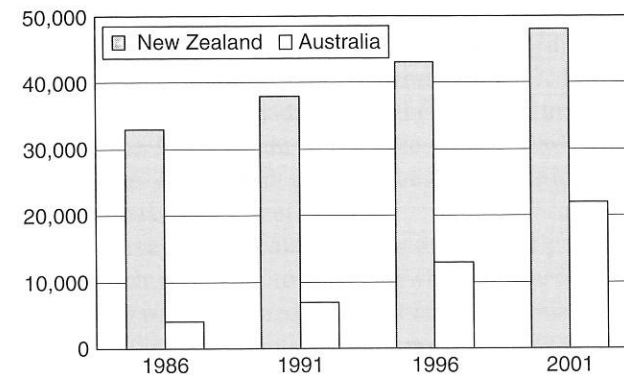


Fig. 10.2. Cook Islanders in New Zealand and Australia, 1986–2001 (Australian Bureau of Statistics 2002; Statistics New Zealand 2006).

adult offspring living overseas, predominantly to their parents. Indicators of economic growth, such as gross national product, show the Cook Islands to have among the fastest growing economies of the Pacific Island nations, against a high baseline in 1985 (Fig. 10.3). Food prices also dropped relative to the cost of all other consumer goods between the mid 1970s and mid 1990s. Figure 10.4 shows the consumer price index of food as a percentage of all consumer groups combined (food, housing, household operation, apparel, transport, tobacco and alcohol, miscellaneous).

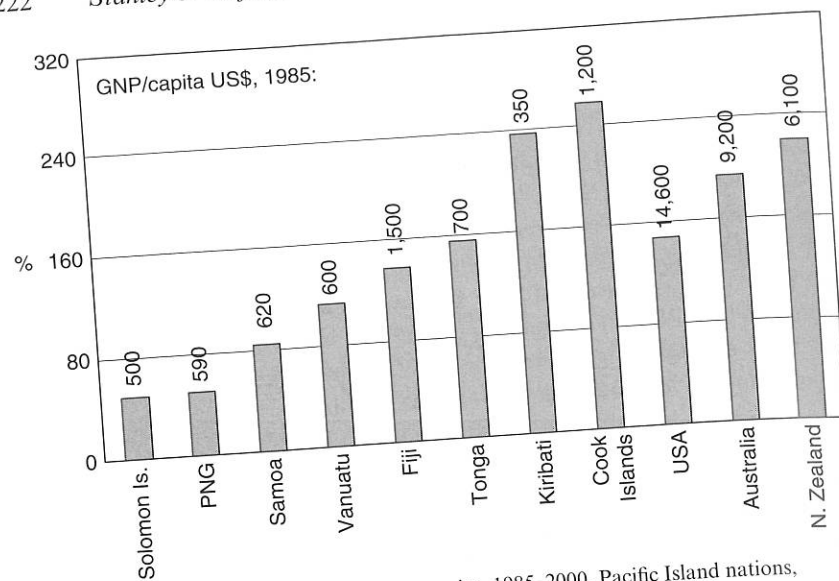


Fig. 10.3. Economic growth per capita, 1985–2000, Pacific Island nations, United States, Australia and New Zealand (World Bank 2001).

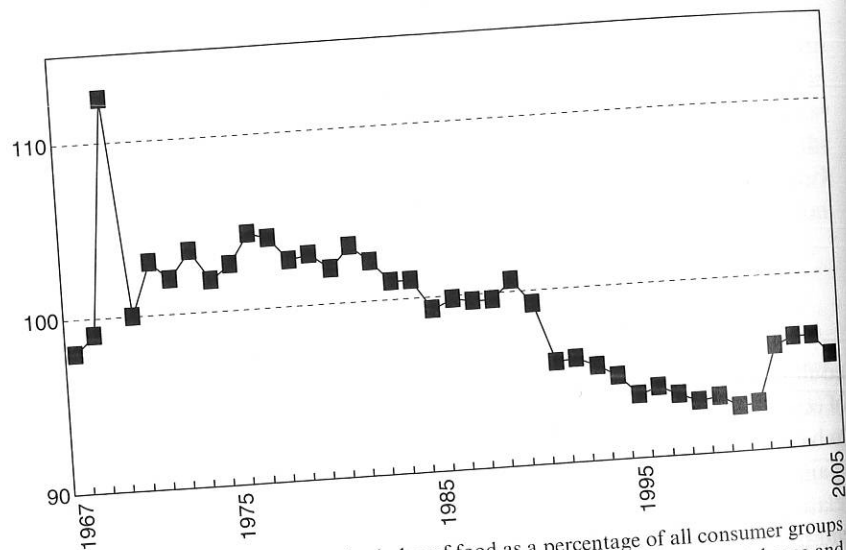


Fig. 10.4. Consumer price index of food as a percentage of all consumer groups combined (food, housing, household operation, apparel, transport, tobacco and alcohol, miscellaneous) (calculated from National Statistical Office, Cook Islands 1996; Cook Islands Statistics Office 2006a,b).

The vast majority of Cook Islander migrants to Australia and New Zealand have settled predominantly in one of three cities: Auckland, Sydney and Melbourne. The population structure of Cook Islanders in New Zealand is the youngest of all the Pacific Islander communities resident in that country, which are in turn much younger than the total New Zealand population (Cook *et al.* 1999). Furthermore, adult Cook Islanders in Melbourne are much younger than the general adult population on Rarotonga. There has been scant study of nutritional health of Cook Islanders in New Zealand, and none at all in Australia. In 1998, I carried out a small survey among Cook Islanders resident in the Brunswick and Clayton districts of Melbourne to obtain the first measures of nutritional health in this growing migrant population.

#### Dietary change among Cook Islanders, 1952–2000

The diet of Cook Islanders in the Cook Islands has undergone considerable change across the past half century. Food availability and consumption is described from food frequency data collected on Rarotonga in 1952 by Fry (1957a,b), as part of fieldwork there in 1996 (Ulijaszek 2002) and among Cook Islanders in Melbourne, Australia, in 1997. This is compared with national food availability data for other nations in the Asia-Pacific region, and on the Pacific Rim across the period 1961 to 2002, using analyses from the Food and Agriculture Organisation (FAO 2006) FAOSTAT food balance dataset.

Early dietary surveys on Rarotonga show that a largely traditional Cook Islander diet (which is similar to diets elsewhere in the Pacific, including Tonga and Samoa) was consumed in 1952, but that this was already supplemented with significant amounts of imported foods (Fry 1957a,b). The typical rural diet of Cook Islanders on Rarotonga in 1952 largely comprised of the root crop taro (*Colocasia* species), banana, breadfruit, fresh fish and coconut, with significant amounts of bread and tea or coffee with sugar also being consumed (Fry 1957a,b). Table 10.2 gives a comparison of food consumption frequency data collected on Rarotonga in 1952 and 1996, and in Melbourne in 1997. Data collection strategies were different in the two Rarotonga surveys; the 1952 data shows the percentage of families having eaten different foods across a seven- to ten-day period, while the 1996 data gives the proportion of women having eaten different foods in the previous 24 hours, obtained using a short self-administered 16-item food-frequency questionnaire (FFQ) among 379 Cook Islanders aged 22 to 86 years. The short FFQ was chosen as a minimally invasive method because subjects were



Table 10.2. *Diet of Cook Islanders, from food frequency questionnaire, Rarotonga and Melbourne*

	Rarotonga			Melbourne
	% families 1952	% all adults 1996	% younger adults <sup>a</sup> 1996	% younger adults <sup>a</sup> 1997–98
Traditional staples (tubers)	100	91	89	61
Coconut	100	39	26	31
Fresh fish	95	37	34	23
Fruits and vegetables	62	100	69	75
Bread and rice	100	94	87	100
Tinned meat	83	72	85	93

Note:

<sup>a</sup> Proportion of adults aged 18–40 years consuming different food categories during the previous day.

resistant to the longer questionnaire piloted prior to the study. The short questionnaire was drawn up and pilot-tested as a consequence. The 16 items used in the FFQ were taro, cassava, banana, coconut, fresh fish, tinned fish, prawns, green vegetables, other vegetables, fruit of all types, beer, alcoholic liquor or wine, fresh meat, tinned meat, biscuits and bread. The 1997 Melbourne survey uses the same methods as the 1996 Rarotonga survey.

On Rarotonga, in both 1952 and 1996, bread and rice were eaten as often as traditional staples, although greater quantities of traditional staples were more likely to have been consumed than imported wheat and wheat products, and rice. The frequency of consumption of coconut and fresh fish was apparently much lower in 1996 than in 1952. Since fish and coconut cream are eaten in combination as part of the traditional diet of Cook Islanders (Fry 1957a; Ulijaszek 2002), and availability of coconut oil showed considerable decline across the period 1972 to 1987 (Ulijaszek 2003), it is likely that the difference in fish consumption frequency is a reflection of true dietary change. In 1952, fresh fish consumption was 1,733 g/family/day, while consumption of coconut cream (not whole coconut) was 1,393 g/family/day, both items being eaten daily by the vast majority of families (Fry 1957b). In 1996, various informants, especially older ones, lamented the decline in subsistence fishing to the author, again suggesting a decline in the consumption of fish caught using traditional methods. The pattern of food consumption in Melbourne is quite similar to that of the younger residents of Rarotonga, suggesting that modernization of the diet on both the capital Cook Island and among migrants in Australia may have proceeded in tandem.

Table 10.3. *Daily per capita (grams) availability, 1961*

	1961				2002			
	Fat				Fat			
	Vegetable	Animal	Total	Meat	Vegetable	Animal	Total	Meat
Cook Islands	174	5	179	8	78	49	127	131
Fiji	159	10	169	35	51	38	89	107
French Polynesia	31	12	43	74	60	62	122	279
Kiribati	36	2	38	44	84	21	105	93
New Caledonia	39	10	49	126	67	48	115	179
Papua New Guinea <sup>a</sup>	33	3	36	46	53	4	57	61
Vanuatu	21	8	29	32	58	29	87	91
New Zealand	2	59	61	286	33	82	115	292
Australia	9	43	52	285	58	73	131	298
United States	33	30	63	243	85	72	157	340
Japan	10	3	13	21	50	35	85	120

Note:

<sup>a</sup> No data for 2002, so data for 2000 given.

Source: From FAO (2006)

National food balance data (FAO 2006) shows the Cook Islands diet in 1961 to have contained more fat and less meat than that of New Zealand, the United States and Japan (FAO 2006) (Table 10.3). Dietary fat availability to Cook Islanders was similar to that of Fiji, but much higher than French Polynesia, Kiribati, New Caledonia, Papua New Guinea and Vanuatu. The Cook Islands had the lowest meat availability among all Pacific Island nations for which there is data. However, all Pacific Island nations showed an increase in meat availability between 1961 and the early 2000s. Dietary fat availability increased in French Polynesia, Kiribati, New Caledonia, Papua New Guinea and Vanuatu across the same period, but decreased in both Fiji and the Cook Islands.

### Blood pressure, body fatness and type 2 diabetes

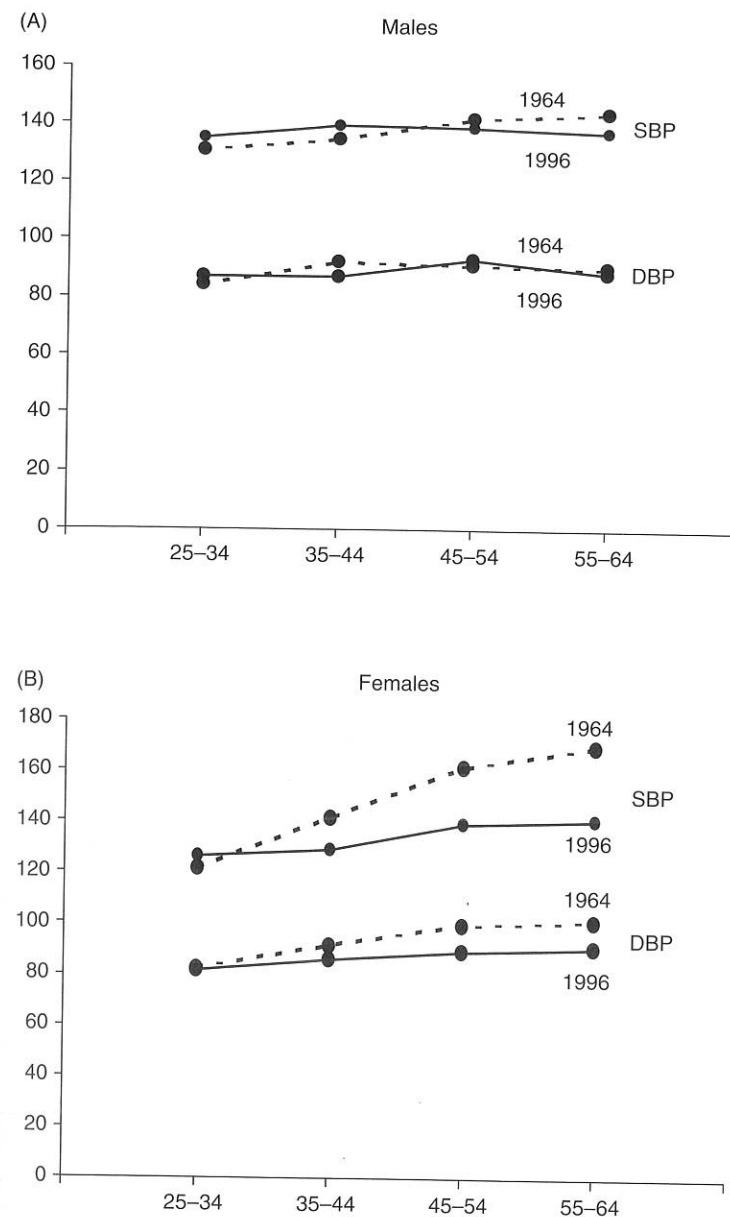
#### Blood pressure

In the Cook Islands, studies in 1953 and 1964 showed adults living on the remote island of Pukapuka to have low mean blood pressure (Murphy 1955; Prior *et al.* 1968), while adults on the modernizing island of Rarotonga in 1964 were shown to have an increase in blood pressure

with age, and to be taller and heavier, with higher blood pressure than subjects on Pukapuka in the same year (Prior *et al.* 1968). A comparison of mean blood pressure of 425 adults on Rarotonga in 1996 (Ulijaszek and Koziel 2003) with the 1964 data showed no difference across this period for males, and a decline for females. Blood pressure of males was elevated at both times and across all age groups in both 1964 and 1996, but did not show any increase with increasing age in 1996. Blood pressure of females was not elevated in the youngest age group in both 1964 and 1996. However, the elevation with age in both systolic and diastolic blood pressure is much less marked in 1996 than in 1964 (Fig. 10.5). This difference is most likely due to more extensive use of anti-hypertensive medication among those diagnosed as having high blood pressure since 1964.

Factors associated with blood pressure among adults on Rarotonga in 1996 were examined in more detail, using forward stepwise multiple regressions with systolic and diastolic blood pressure as dependent variables, respectively. Independent variables used in these analyses were body size (BMI), diabetes status (fasting blood glucose), physical activity level (averaged across three days), diet and modernization factors (education, occupation, remittances from overseas, number of close relatives in New Zealand and Australia) (Ulijaszek 2001a,b,c). For males, systolic blood pressure in 1996 is positively associated with BMI, remittances from relatives overseas, age and fasting blood glucose, but negatively associated with use of anti-hypertension medication ( $r^2=0.25$ ;  $F=6.2$ ;  $p<0.001$ ). For females, it is positively associated with remittances from relatives overseas, age and BMI ( $r^2=0.15$ ;  $F=11.3$ ;  $p<0.001$ ). Diastolic blood pressure of males is positively associated only with remittances from relatives overseas ( $r^2=0.06$ ;  $F=6.3$ ;  $p<0.05$ ). For females, it is positively associated with BMI, age and number of close relatives living in New Zealand, but negatively associated with use of anti-hypertensive medication ( $r^2=0.13$ ;  $F=7.2$ ;  $p<0.001$ ). Expected interrelationships of blood pressure with increasing age, overweight, obesity and diabetes are confirmed for this population. However, this analysis also demonstrates the importance of remittances and transnational connections for elevated blood pressure, and supports the view that anti-hypertension medication is responsible for reducing high blood pressure levels in the face of multiple factors that would otherwise contribute to its elevation in this population.

A comparison of blood pressure, anthropometry and diabetes status of Cook Islanders resident in Melbourne, Australia, with those of their counterparts living on Rarotonga, measured in 1996, of the same age group, is given in Table 10.4. Cook Islanders aged 18 to 45 years in Melbourne had



SBP – Systolic blood pressure

DBP – Diastolic blood pressure

Fig. 10.5. Blood pressure of Cook Islanders on Rarotonga, 1964 and 1996 (from Ulijaszek and Koziel 2003).

Table 10.4. *Anthropometry and blood pressure of Cook Islander males and females aged 18–45 years on Rarotonga and in Melbourne, Australia*

## (A) Males

Sample	Rarotonga		Melbourne	
	16		23	
	Mean	SD	Mean	SD
Age (years)	36.1	7.0	37.3	7.6
Stature (cm)	174.6	7.2	170.8	5.4
Weight (kg)	101.2	13.3	92.8	18.8
BMI	33.3	4.5	31.7	5.8
Systolic BP	134.6	16.3	135.0	16.6
Diastolic BP	86.4	17.6	91.5	13.1
Fasting blood glucose (mg/dl)	6.4	4.0	6.0	3.1

Note:

All not statistically significant.

## (B) Females

Sample	Rarotonga; Blood pressure and/or diabetes medication		Rarotonga; no blood pressure and/or diabetes medication		Melbourne		One way ANOVA
	10		43		42		
	Mean	SD	Mean	SD	Mean	SD	F
Age (years)	35.7	6.1	35.5	7.0	35.6	6.6	0.3
Stature (cm)	160.0	7.4	163.7	7.9	162.5	7.7	0.6
Weight (kg)	101.5*	18.1	88.8	16.7	89.2	19.5	1.7
BMI	39.8**	7.6	33.1	5.6	33.5	8.5	5.5**
Systolic BP	133.4	17.8	125.1	15.9	127.3	18.3	2.0
Diastolic BP	86.7	12.3	82.4	12.2	84.8	13.5	1.3
Fasting blood glucose (mg/dl)	7.0	5.6	5.8	4.1	6.2	5.2	1.8

Note:

\* $p < 0.05$ ; \*\* $p < 0.01$ .

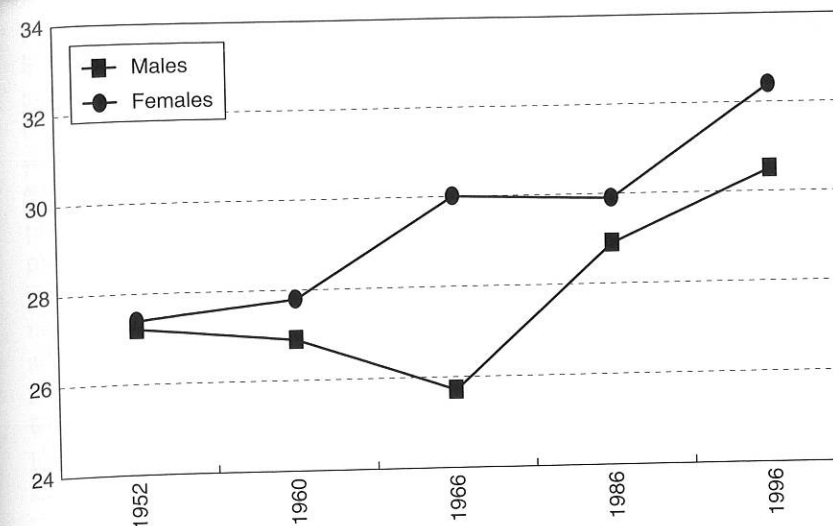


Fig. 10.6. Mean body mass index of Cook Islander adults, 1950s to the 1990s (data from Fry 1957b; Hunter 1962; Evans and Prior 1969; Katoh *et al.* 1990; Ulijaszek 2001a).

similar blood pressures to those on Rarotonga who did not take blood pressure medication at the time of survey.

*Body size*

The body size of adult Cook Islanders living on the main island of Rarotonga has increased since at least 1952 (Ulijaszek 2003) (Fig. 10.6). While males and females had similar BMIs in 1952 (27.2 kg/m<sup>2</sup>, males; 27.4 kg/m<sup>2</sup>, females), this increased by 5.0 kg/m<sup>2</sup> for females and 3.3 kg/m<sup>2</sup> for males by 1996. There has also been an associated secular trend towards increased stature of adults at least since 1966, largely because of improved nutritional status in childhood which has resulted in increased height as well as weight (Ulijaszek 2001a). The rates of secular trend in stature (cm/decade) and weight (kg/decade) of women between 1952 and 1996 are given in Table 10.5. In all cases, the rate of increase was higher between 1966 and 1996 than between 1952 and 1966, being much greater for weight than for stature. This suggests that there were much greater increases in the rates of overweight and obesity in the later period than the former, concomitant with greater rates of stature increase. Table 10.6 shows the proportion of adults that would be classified as obese by the World

Table 10.5. *Rates of secular increase in adult body size in Cook Islander women aged 20–40 years*

Period	Stature (cm/decade)		Weight (kg/decade)	
	20–29 years	30–39 years	20–29 years	30–39 years
1952–66	0.5	0.5	0.6	3.2
1966–96	0.63	1.0	7.3	5.1

Table 10.6. *Proportion of the sample classified as obese (body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup>), by age group*

Age group (years)	Sample size				Proportion with BMI $> 30$ (%)			
	Males		Females		Males		Females	
	1966	1996	1966	1996	1966	1996	1966	1996
20–29	83	5	73	18	20	100	30	56
30–39	44	10	30	27	11	70	50	63
40–49	39	27	39	48	13	59	56	58
50–59	39	40	32	85	10	53	53	56
60+	33	65	32	99	15	37	43	53
Total					14	52	44	57

Source: Adapted from Ulijaszek (2001a).

Health Organization (2000) criterion of BMI  $\geq 30$  kg/m<sup>2</sup>. There has been a significant increase in obesity among both males and females (Ulijaszek 2001a). The proportion of obese males had increased from 14% in 1966 to 52% in 1996. Among females, obesity prevalence rates increased from 44% in 1966 to 57% in 1996. The secular trend towards increased body size and obesity on Rarotonga has been shown to be associated with economic modernization and level of education (Ulijaszek 2001b).

Factors associated with body size among adults on Rarotonga in 1996 were examined in detail, again using forward stepwise multiple regressions, with BMI as the dependent variable. Independent variables used in this analysis were blood pressure (systolic and diastolic), diabetes status (fasting blood glucose), physical activity level (averaged across three days), diet (different food and food categories) and modernization factors (education, occupation, remittances from overseas, number of close relatives in New Zealand and Australia). BMI was positively associated with systolic blood

pressure but negatively associated with age and weekday physical activity level for males ( $r^2 = 0.27$ ;  $F = 8.4$ ;  $p < 0.001$ ); it is positively associated with systolic blood pressure but negatively associated with age for females ( $r^2 = 0.15$ ;  $F = 16.9$ ;  $p < 0.001$ ). The expected relationships between blood pressure, increasing age and BMI are confirmed for both males and females. This analysis also demonstrates an inverse relationship between weekday physical activity and BMI for males only. The variable 'occupation' reflects physical activity in the workplace, as well as income. Since it showed no relationship with BMI in this analysis, it suggests that physical activity during non-work time is more important for the control of BMI than is physical activity at work. Cook Islander females in Melbourne aged 18 to 45 years have similar mean stature, weight and BMI to women born on Rarotonga who did not take anti-hypertension medication (Table 10.4); the latter are heavier and with higher BMI than the former. Males in Melbourne have similar stature, weight and BMI to their counterparts on Rarotonga.

### Type 2 diabetes

With respect to type 2 diabetes, 27% of females and 26% of males on Rarotonga had fasting blood glucose greater than 8 mg/l, a level suggestive of diabetes (World Health Organization 1985). Factors associated with type 2 diabetes were examined in more detail by using binary logistic regression analysis with diabetes status (fasting blood glucose less than or greater than 8 mg/l) as the dependent variable. The independent variables used were physical activity level, diet, the same modernization factors employed in the earlier analyses, BMI and blood pressure. For the males, type 2 diabetes was associated with the use of anti-diabetes medication (Wald statistic 8.1,  $p < 0.01$ ) and systolic blood pressure (Wald statistic 4.0,  $p < 0.05$ ) only. Among females, type 2 diabetes was associated with the use of anti-diabetes medication (Wald statistic 15.7,  $p < 0.001$ ) and BMI (Wald statistic 3.8,  $p = 0.05$ ). Both males and females in Melbourne had fasting blood glucose which was similar to their counterparts on Rarotonga, whether or not they took anti-diabetes medication.

### Conclusions

Cook Islanders have experienced increased levels of obesity since at least the 1950s, attaining one of the highest prevalences of obesity in the world by the 1990s. The earliest surveys of blood pressure, in the 1960s, showed



that increases had already taken place on the most modernized island, Rarotonga, but not elsewhere in the Cook Islands. Unlike body fatness and obesity, however, blood pressure stabilized among males, albeit at high levels, and declined for females, mostly because of the availability and use of anti-hypertension medication by a large proportion of the adult population, in the face of strong continuing modernizing influences. Type 2 diabetes prevalence was also high in 1996, but was kept in check largely by anti-diabetes medication. The importance of transnational connections (in the form of remittances and perhaps social influences of close relatives living in New Zealand) for elevated blood pressure is also confirmed, as is the importance of physical activity for lower BMI among males but not females. Diet does not emerge as a factor contributing to the prevalence of obesity, hypertension and diabetes in the Cook Islands, perhaps because transnational factors are stronger influences for all aspects of health-related behaviour, and not for dietary patterns alone. Perhaps the most important modernising influence has been that of medication for the control of diabetes and hypertension. No such medications are currently available for the control of obesity; if there were, Cook Islanders would be likely to embrace them wholeheartedly.

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