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Globalization, diet, and health: an example from Tonga

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Abstract The increased flow of goods, people, and ideas associated with globalization have contributed to an increase in noncommunicable diseases in much of the world. One response has been to encourage lifestyle changes with educational programmes, thus controlling the lifestyle-related disease. Key assumptions with this approach are that people's food preferences are linked to their consumption patterns, and that consumption patterns can be transformed through educational initiatives. To investigate these assumptions, and policies that derive from it, we undertook a broad-based survey of food-related issues in the Kingdom of Tonga using a questionnaire. Data on the relationships between food preferences, perception of nutritional value, and frequency of consumption were gathered for both traditional and imported foods. The results show that the consumption of health-compromising imported foods was unrelated either to food preferences or to perceptions of nutritional value, and suggests that diet-related diseases may not be amenable to interventions based on education campaigns. Given recent initiatives towards trade liberalization and the creation of the World Trade Organization, tariffs or import bans may not serve as alternative measures to control consumption. This presents significant challenges to health policy-makers serving economically marginal populations and suggests that some population health concerns cannot be adequately addressed without awareness of the effects of global trade.

Keywords Eating; Food preferences; Nutritive value; Food/supply and distribution; Diet/economics; Commerce; Treaties; Diet surveys; Tonga (*source: MeSH*).

Mots clés Manger; Préference alimentaire; Valeur nutritive; Aliment/ressources et distribution; Régime alimentaire/économie; Commerce; Traités; Enquête régime alimentaire; Tonga (*source: INSERM*).

Palabras clave Ingestión de alimentos; Preferencias alimentarias; Valor nutritivo; Alimentos/provisión y distribución; Dieta/economía; Comercio; Tratados; Encuestas sobre dietas; Tonga (*fuente: BIREME*).

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Voir page 861 le résumé en français. En la página 861 figura un resumen en español.

Introduction

Since the 1960s, Pacific nations have opened to the movement of people, ideas, and goods, generally termed globalization (*1–10*), resulting in massive increases in the flow both of people (in the form of large-scale migration) and of goods. One effect of globalization has been to increase reliance on imported foods, rather than traditional foods (*11–15*). Globalization has also had profound consequences on health, as can be seen by the rising rates of noncommunicable diseases (NCDs) throughout the Pacific (*16–18*) and in much of the developing world. Imported high fat-content meats, especially corned beef, mutton flaps, and chicken parts and dense simple carbohydrates, such as refined sugar and flour, are among the main causes of the rising rates (*17, 19–21*). WHO has also identified infrastructure problems in health promotion, disease prevention, and primary curative systems as areas of concern (*22*).

Using the Kingdom of Tonga as an example of other microstates in the South Pacific, we examined why imported foods were increasingly consumed instead of traditional foods. We also evaluated the consequences of this dietary change and suggest ways in which the rise in dependence on imported foods can be reversed. Our data indicate that the WHO statement: "Despite the increasing importance of cardiovascular disease and diabetes, awareness of prevention measures and healthy lifestyle have not improved sufficiently among the general population" (*22*) is at best an overgeneralization and at worst untrue. Although educational programmes have increased awareness about healthy diets and nutritional foods, people in the Pacific nonetheless choose to consume less-healthy foods because of cost and availability (i.e. they make economically rational, but

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nutritionally detrimental, decisions to consume certain foods). Thus, poor diet is not simply a health or health-education issue, it is also economic.

Methods

A total of 430 Tongans were asked to participate in the study by completing a brief questionnaire. The questionnaire was written first in English, translated into Tongan, and then back translated. Three people with Tongan as their mother tongue (CF, VL, and Taniela Fusimalohi) and ME, who speaks Tongan as a second language, collaborated on the translations. Five people refused to participate (a refusal rate of 1%). In all, 178 males and 241 females participated in the study (6 respondents failed to report their sex), with ages from 12–82 years old (mean = 36.61 years; standard deviation = 15.62 years).

Setting

The survey was carried out at meetings of church choirs. Because of the importance and wide appeal of the Church and church choirs in Tonga, the age of choir members varies broadly and both sexes are represented. Sites were selected for the ability of the research team to administer the survey effectively and to ensure that a variety of church denominations and geographical locations were represented. Choirs were selected from seven denominations in six villages in all three of the main regions of Tonga (Tongatapu, Ha'apai, and Vava'u). The villages were both rural and urban, in both remote and well-serviced locations. Although not random, the sample was quasi-representative of the population as a whole, because of the inclusion of a range of locations and denominations. The use of choir members as a subject pool did not distort the sample as the vast majority of Tongans regularly attend church and singing in the choir is a popular activity for people of all ages.

Foods selected for study

Respondents were asked to evaluate the following foods: taro (*Colocasia esculenta*), taro greens, giant taro (*Alocasia macrorrhiza*), sweet potato (*Ipomoea batatas*), bread, yam (*Dioscorea alata*), plantain (*Musa paradisiaca*), ma tonga (a type of starchy pudding made from plantain and coconut cream), breadfruit (*Artocarpus altilis*), Tahitian chestnut (*Inocarpus edulis*), hibiscus greens (*Hibiscus manihot*), banana (*Musa sapientum*), cabbage (*Brassica oleracea*), cassava (*Manihot esculenta*), corn (*Zea mays*), rice, doughnuts (cooked in lard), dough-boys (flour dumplings in a sweet coconut-cream sauce), cabin biscuits (a type of flour cracker), flour noodles, octopus, whale, shellfish, beef, corned beef, salt beef, goat, fish, tinned fish, horse, turkey tails, imported chicken parts, indigenous chicken (whole), eggs, mutton flaps, pork, sausages or wieners, and dog.

Rating scales

All evaluations were completed on 5-point Likert scales. Respondents where asked to rate their preference for each food on a scale anchored at 1 (very tasty), 2 (tasty), 3 (OK-tasting), 4 (not tasty), and 5 (very poor tasting). Perceptions of nutritional value were evaluated on a scale anchored at 1 (very good for your body), 2 (good for your body), 3 (OK for your body), 4 (not good for your body), and 5 (very bad for your body). Frequency of consumption was measured on a scale anchored at 1 (every day), 2 (two or three times a week), 3 (once a week), 4 (occasionally), and 5 (very rarely). All scale anchors are reported as back-translations from the Tongan anchors.

Results

Most frequently consumed foods

We rated all foods based on their frequency of consumption and identified those that were eaten more than once per week. These foods were cassava (eaten an average of 1.89 times per week), bread (2.09), mutton flaps (2.26), taro greens (2.30), hibiscus greens (2.46), fish (2.61), yams (2.78), and imported chicken parts (2.90).

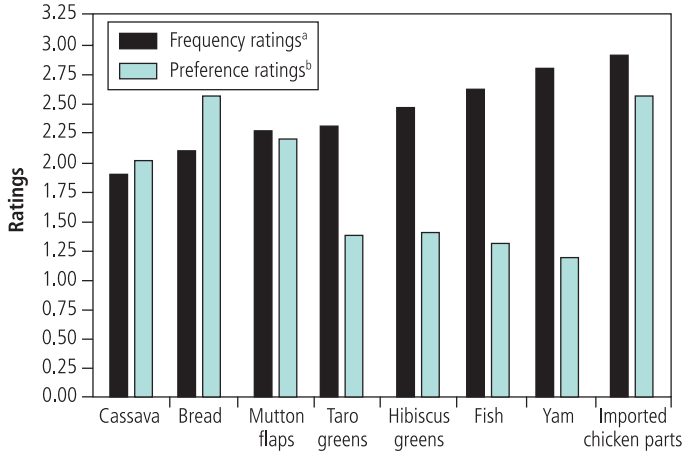
Preference and consumption

We conducted an 8 (food) by 2 (rating: frequency, preference) within-subject analysis of variance (ANOVA) on the ratings. There was a significant interaction between the food consumed and the preference rating, $F(7, 2569) = 121.39$; $P < 0.0001$. As can be seen from Fig. 1, the most-preferred foods were eaten less frequently than less-preferred foods. The mean preference ratings were 2.02, 2.57, 2.19, 1.37, 1.39, 1.29, 1.17, and 2.56, respectively, for the above foods. Although bread, mutton flaps, and imported chicken parts were among the least-preferred of the most-frequently consumed foods, they were still consumed at a relatively high rate, indicating that preference has little to do with consumption patterns. These three foods, which have been linked to diet-related noncommunicable diseases, were consumed despite people's inclinations and tastes.

Perceived nutritional value

People's preferences, frequency of consumption, and perceptions of nutritional value were compared for six key foods (Fig. 2). A 6 (food) by 3 (rating: preference, nutritional value, frequency of consumption) within-subject ANOVA showed there was a significant interaction between food and the three ratings, $F(10, 3310) = 301.70$, $P < 0.0001$. Fisher's adjusted least significant difference (LSD) tests indicated that means differing by 0.13 or more were significantly different at the $P < 0.05$ level, and that means differing by 0.11–0.13 were marginally significantly different at the $P < 0.10$ level. Thus, on

Fig. 1. **Ratings of frequency of consumption and preference for foods consumed more than once a week**



[a] 1 (very tasty) to 5 (very poor tasting).
[b] 1 (every day) to 5 (very rarely).

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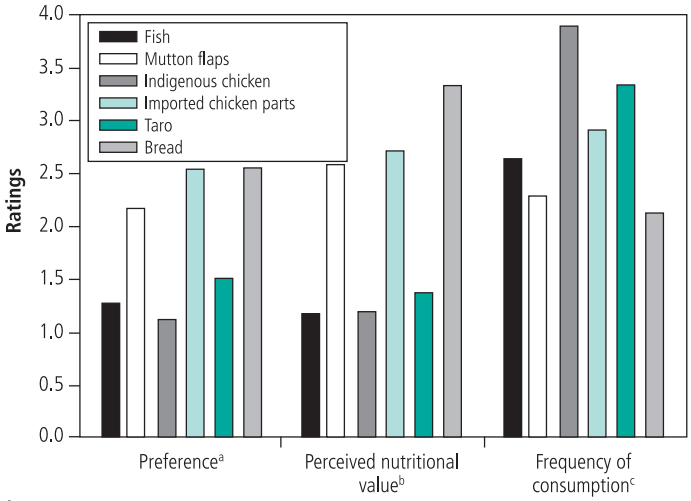
Fig. 2. **Ratings of preference, perceived nutritional value, and frequency of consumption for six key foods**



[a] See Fig.1, footnote b.
[b] 1 (very good for your body) to 5 (very bad for your body).
[c] See Fig.1, footnote a.

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preference ratings, only imported chicken parts and bread failed to differ. On perceived nutritional value, only fish and indigenous chicken failed to differ. On frequency of consumption, all means differed. Clearly, something other than information or inclination motivated the consumption patterns observed, again suggesting that people do not require better nutritional information about the relative merits of high-fat imported foods versus low-fat indigenous foods, or of simple versus complex carbohydrates.

To investigate this issue further, subsequent analyses of perceptions of nutritional value were undertaken. A principal axis factor analysis with an oblique rotation was conducted on the ratings of perceived nutritional value for all foods in the survey. A scree test indicated a six-factor solution. The factors, described in Table 1, were reasonably uncorrelated (the correlations varied from 0.01 to 0.34). The means of the ratings of perceived nutritional value of the items in each factor served as indices of the perceived nutritional value of each factor: the Cronbach's values are shown in Table 1.

A low rating score (e.g. a value of 1) indicated a high perceived nutritional value and a high score (e.g. a value of 5) indicated a low perceived nutritional value. A within-subject ANOVA on these rating scores (see Fig. 3) found that low-fat traditional foods (mean = 1.39) were perceived as most nutritious, followed by traditional root vegetables (1.71), traditional complex carbohydrates (1.98), low-frequency consumption traditional foods (2.04), fatty meats (2.38), and imported simple carbohydrates (3.28), the latter being perceived as the least nutritious: $F(5, 2065) = 747.33$, $P < 0.0001$. LSD tests indicated that all means differed at the $P < 0.05$ level, except traditional complex carbohydrates and low-frequency consumption traditional foods, which differed marginally at the $P < 0.06$ level.

Respondents' knowledge. This analysis, and especially the manner in which the foods formed into factors, indicates considerable sophistication and awareness of the respondents regarding nutritional issues. For example, almost all pork is locally produced and is fatty (because pigs are fed on coconuts); the inclusion of pork in the fatty-meat factor indicates that the respondents were aware of the nutritional similarities between indigenously raised pork and imported meats, such as mutton flaps. This awareness was not obscured or mediated by the high cultural values ascribed to the exchange and consumption of pigs in Tonga.

It is also apparent that the respondents had a relatively accurate perception of the nutritional value of the foods they consume. Tonga has actively promoted diet-related health education programmes (*17*); indeed the King of Tonga has taken an active and personal role in promoting weight loss. Such programmes appear to have had an impact on perceptions; however, these perceptions have not translated into reduced consumption of imported fatty foods.

Discussion

In Tonga, diet-related diabetes, high blood pressure, and heart disease are among the primary health concerns (*16–18, 23–26*). The negative consequences of dietary changes associated with economic development have been noted among aboriginal communities in North America (*27–30*), where the shift from low-fat, high-quality wild meats, to high-fat, low-quality meats and low fibre/low complex carbohydrate is particularly significant (*31–35*). Generally, development and associated urbanization trends increase the incidence and distribution of noncommunicable diseases (*36–38*; for the Pacific region see *11, 13, 14*) and data for Tonga confirm that a pattern of high rates of obesity, diabetes, and

cardiovascular disease has emerged with the shift from traditional diets (*21, 23, 39–41*).

Choice of diet

The data indicate that the Tongans were aware of the various nutritional values of the foods they consumed. It is also clear that simple preference was not the motivating force behind the frequent consumption of imported fatty foods and simple carbohydrates. Instead, healthier low-fat Tongan sources of proteins, such as fish, generally cost between 15% and 50% more than either mutton flaps or imported chicken parts, and in many areas mutton flaps and imported poultry were more easily purchased than fish or indigenous chicken. The same can be said of imported simple starches, such as bread and rice, in contrast to the locally available taro. Not only are the health consequences of these imported foods detrimental, but the availability of these cheap imports is also constraining the development of domestic markets (*42*).

Balance of trade and food security

Food security and balance of trade have long been of concern in the Pacific (*8, 9*), but in Tonga the negative balance of trade is critical (*43*). Food imports are significant factors in both issues. Although imports of mutton flaps for 1999 were dramatically lower than for the peak year of 1994 (*39*, *44–48*; see also Table 2), this improvement was more than offset by increases in other imported meats, especially poultry from the USA.

Table 3 compares the levels of key imported meats in 1989 and 1999; they represented just less than one-third of total imported foods in 1989, and just more than one-third in 1999. Overall, food imports increased in tandem with total imports and remained at approximately 25% of total imports. In 1989, total imports were valued at T$ 68 million, of which almost T$ 17 million were for food; in 1999 total imports were valued at T$ 116 million, of which T$ 30 million were for food. Given the moderate increase in population between 1989 and 1999 (from 96 076 to 99 821 (*39*)), the increase in meat import levels is comparatively large. The cost of imported meats has almost doubled, from T$ 5 to 10 million (Table 3), while per capita consumption has increased over 60%, from 35 to 56 kilos per person. The balance of trade has deteriorated in conjunction with the increase in imports. In 1989, Tonga had a trade deficit of T$ 56 million, but this had grown to T$ 96 million by 1999.

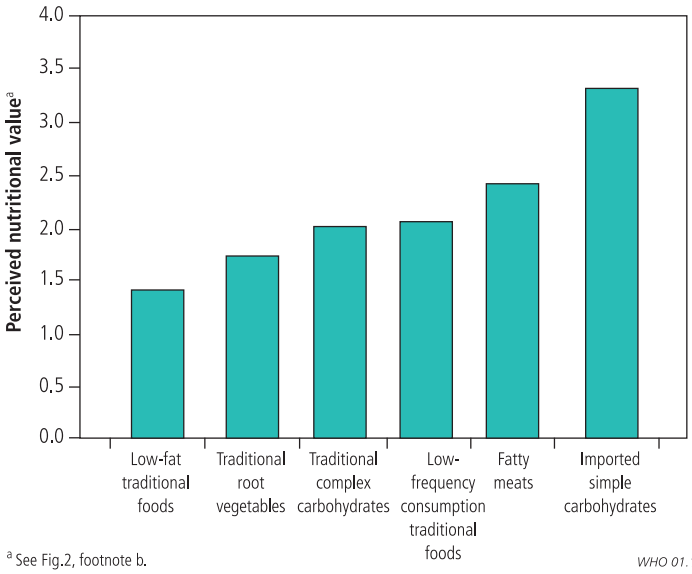
Trade liberalization and health

A review of linkages between liberalization of trade and health suggested a mechanism for balancing the overall global benefit of increased economic activity with the health-related problems that may result from this activity (*49*). According to Article XX(b) of the General Exemptions section of the General Agreement on Tariffs and Trade (GATT), as well as subsequent international trade agreements, hazardous imports can be regulated, though such regulations are circumscribed by the overall goal of liberalized trade. Commodities can be classified into four categories: legal and beneficial; legal and of doubtful benefit; legal and harmful; and illegal and harmful. While a legal but harmful commodity, specifically tobacco, can provide a clear example for exploring trade regulation in relation to national health priorities and policies, commodities in the second category, legal and of doubtful benefit, can be problematic. It has been pointed out that certain goods, such as tobacco and weapons, are intrinsically

Table 1. **Results from scree test, Tonga**

Factor	Examples	Proportion of total variance (%)	Cronbach's α
Fatty meats	pork, corned beef, salt beef, sausages, imported chicken parts, and turkey tails.	20.20	0.83
Low-frequency consumption traditional foods	Tahitian chestnut, shellfish, cabbage, goat, whale, horse, and dog.	8.65	0.74
Imported simple carbohydrates	doughnuts, flour noodles, bread, cabin biscuits, rice, and dough-boys.	6.53	0.83
Traditional complex carbohydrates	corn, breadfruit, plantain, and banana.	4.50	0.73
Low-fat traditional foods	taro greens, beef, octopus, eggs, indigenous chicken, hibiscus greens, and fish.	3.30	0.57
Traditional root vegetables	yam, sweet potato, cassava, taro, and giant taro.	2.77	0.79

Fig. 3. **Ratings of perceived nutritional value as a function of type of food**



[a] See Fig.2, footnote b.

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Table 2. **Import of mutton flaps to Tonga, selected years from 1976 to 1996**

Year	Quantity (tonnes)	Cost (CIF[a]) (million T$[b])
1976	1435	0.4
1979	2207	1.1
1982	1572	1.3
1985	2512	2.9
1988	2238	2.7
1991	2585	2.5
1994	3543	3.1
1996	2941	4.5

Source: ref. *39*.

[a] CIF = cost insurance and freight.

[b] T$ = Tongan dollar (*Pa'anga*). Equivalent to US$ 0.52, May 2001.

Table 3. **Import of selected meats to Tonga, 1989 and 1999**

Food	1989		1999	
	Quantity (tonnes)	Cost (CIF[a]) (million T$[b])	Quantity (tonnes)	Cost (CIF) (million T$)
Mutton flaps[c]	2037	2.3	1837	3.2
Chicken parts[d]	789	1.1	2569	3.5
Sausages[e]	59	0.1	505	0.8
Corned beef[f]	502	1.8	647	2.7
Total	**3389**	**5.3**	**5559**	**10.2**

Source: ref. *44–48*.

[a] See Table 1, footnote a.

[b] See Table 1, footnote b.

[c] Standard International Trade Classification (SITC) code 011.21.

[d] SITC code 011.41.

[e] SITC codes 013.40 and 013.41 combined.

[f] SITC code 013.9.

hazardous, whereas the hazardous nature of other goods, such as alcohol, depends on their use or abuse. Other commodities, such as food, are only hazardous when contaminated (*49*). The problem with such a distinction is that certain foodstuffs are hazardous when consumed frequently.

Tongan consumption of less-nutritious imported foods predates recent changes in global trade regulation and the creation of the World Trade Organization (WTO). Nonetheless, the patterns described above are perilous, in part because there may be very limited proactive responses available to national governments and health authorities, due to the conditions on trade regulated by the WTO. In the case of Tonga, currently an observer to the WTO, ascension to full membership (the negotiations for which must begin after five years of observer status) will require compliance to GATT (*50*), and thus severely limit tariff-based responses to the current crisis. Fiji, which suffers from an analogous public health problem regarding mutton flaps and imported chicken parts, recently imposed a complete ban on the products (*51*), but as a full member of WTO it is under threat of a complaint by New Zealand (*52*).

Conclusions

It appears that the solution to diet-related noncommunicable diseases in Tonga cannot be based solely on nutritional education. Both the problem and the solution appear to involve economics. One possible answer would be to follow the example of Fiji and ban the importation of fatty foods. Other policy alternatives would promote the development of sustainable indigenous fishing and farming industries that could make the preferred and healthier traditional foods readily available at reduced cost. However, both these solutions could run afoul of GATT and WTO, which illustrates the challenges faced by population health management in the global era. Article XX, General Exceptions, of GATT states: "Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures ... necessary to protect human, animal or plant life or health ..." (*53*). How this part of the GATT will be interpreted and modified remains to be seen. Nonetheless, it behoves national policy-makers to be aware of the health impact of "commodities of doubtful benefit", and of the role of trade in health of the population. ■

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Conflicts of interest: none declared.

Résumé

Mondialisation, alimentation et santé : l'exemple des Tonga

L'intensification des échanges de biens, de personnes et d'idées associée à la mondialisation a contribué à une augmentation, à l'échelle mondiale, des maladies non transmissibles liées au mode de vie. Pour lutter contre ce type de maladies, une des approches consiste à encourager des modifications du mode de vie grâce à des campagnes d'éducation. Cette approche part du principe que les préférences alimentaires des gens sont liées à leurs habitudes de consommation et que ces habitudes peuvent être modifiées par des campagnes d'éducation. Pour tester cette hypothèse et les politiques qui en découlent, nous avons entrepris une vaste enquête sur les questions liées à l'alimentation au Royaume des Tonga au moyen d'un questionnaire. Des données portant sur les relations entre les préférences alimentaires, la valeur nutritionnelle attribuée aux aliments et la fréquence de la consommation ont été réunies aussi bien pour des aliments traditionnels que pour des aliments importés. Les résultats montrent que la consommation d'aliments importés préjudiciables à la santé n'a aucun rapport ni avec les préférences alimentaires ni avec la valeur nutritionnelle attribuée aux aliments, ce qui laisserait supposer que des interventions reposant sur des campagnes d'éducation seraient sans effet sur les maladies liées à l'alimentation. Compte tenu des récentes initiatives en faveur de la libéralisation des échanges et de la création de l'Organisation mondiale du Commerce, il n'est pas possible d'utiliser les tarifs douaniers ou d'interdire certaines importations pour contrôler la consommation. Cela représente un véritable défi pour les responsables des politiques de santé appelés à desservir des populations économiquement marginales et laisse supposer qu'il est impossible de traiter certains problèmes de santé de la population sans une prise de conscience des effets du commerce mondial.

Resumen

Globalización, alimentación y salud: un ejemplo extraído de Tonga

El creciente flujo de bienes, personas e ideas que conlleva la globalización ha favorecido el aumento de las enfermedades no transmisibles en gran parte del mundo. Una respuesta frente a ello ha consistido en fomentar cambios del modo de vida mediante programas educacionales, para combatir así las enfermedades relacionadas con ese factor. Dos premisas clave de ese planteamiento son que las preferencias de la gente por determinados alimentos están relacionadas con sus hábitos de consumo, y que esos hábitos pueden modificarse mediante iniciativas educacionales. A fin de investigar la validez de esas premisas, así como las políticas de ellas derivadas, llevamos a cabo en el Reino de Tonga, mediante un cuestionario, una encuesta amplia sobre cuestiones relacionadas con los alimentos. Se reunieron datos sobre la relación entre las preferencias de alimentos, la percepción de su valor nutritivo y la frecuencia de consumo, tanto para alimentos tradicionales como para alimentos importados. Los resultados muestran que el consumo de alimentos importados que comprometían la salud no guardaba relación ni con las preferencias alimentarias ni con la percepción de su valor nutritivo, lo que lleva a pensar que probablemente las enfermedades relacionadas con la alimentación no se prestan a intervenciones basadas en campañas educativas. Considerando las recientes iniciativas de liberalización del comercio y la creación de la Organización Mundial del Comercio, la imposición de aranceles aduaneros y la prohibición de importaciones podrían no ser alternativas válidas para controlar el consumo. Esto plantea retos importantes para los formuladores de políticas sanitarias que atienden a poblaciones económicamente marginales, e indica que no es posible abordar adecuadamente algunos de los problemas que afectan a la salud de las poblaciones sin tener en cuenta los efectos del comercio mundial.

References

1. **Campbell IC.** A historical perspective on aid and dependency: the example of Tonga. *Pacific Studies*, 1992, **15**: 59–75.
2. **Evans M.** *Persistence of the gift. Tongan tradition in transnational context.* Waterloo, Ontario, Wilfrid Laurier University Press (in press).
3. **Evans M.** Is Tonga's MIRAB economy sustainable?: a view from the village, and a view without it. *Pacific Studies*, 1999, **22**: 172–207.
4. **James K.** Migration and remittances: a Tongan village perspective. *Pacific Viewpoint*, 1990, **32**: 1–23.
5. **James K.** The rhetoric and reality of change and development in small Pacific communities. *Pacific Viewpoint*, 1993, **34**: 135–152.
6. **James K.** Reading the leaves: the role of Tongan women's traditional wealth and other 'contraflows' in the process of modern migration and remittance. *Pacific Studies*, 1997, **20**: 1–27.
7. **O'Meara T.** *Samoan planters: tradition and economic change in Polynesia.* Fort Worth, TX, Holt, Rinehart and Winston, 1990.
8. **Shankman P.** *Migration and underdevelopment: the case of Western Samoa.* Boulder, CO, Westview Press, 1976.
9. **Shankman P.** Phases of dependency in Western Samoa. *Practising Anthropology*, 1990, **12**: 12–20.
10. **Small C.** *Voyages: from Tongan villages to American suburbs.* Ithaca, NY, Cornell University Press, 1997.
11. **Coyne T.** *The effect of urbanization and western diet on the health of Pacific island populations.* Noumea, New Caledonia, South Pacific Commission, 1984.
12. **Pollock NJ.** *These roots remain: food habits in the islands of the central and eastern Pacific since Western contact.* Laie, Hawaii, The Institute for Polynesian Studies, 1992.
13. **Thaman RR.** Food for urbanising Polynesian peoples. *Proceedings of the Nutritional Society of New Zealand*, 1983, **8**: 25–37.

14. **Thaman RR.** Health and nutrition in the Pacific islands: development or underdevelopment. *GeoJournal*, 1988, **16**: 211–227.
15. **Walsh A.** Population changes in Tonga: an historical overview and modern commentary. *Pacific Viewpoint*, 1970, **11**: 27–46.
16. **Collins V, Dowse G, Zimmit P.** Prevalence of obesity in Pacific and Indian Ocean populations. *Diabetes Research and Clinical Practice*, 1990, **10**: 529–532.
17. **Englberger L et al.** The Tonga Healthy Weight Loss Program 1995–97. *Asia Pacific Journal of Clinical Nutrition*, 1999, **8**: 142–148.
18. **Hodge A, Dowse G, Zimmet P.** Obesity in pacific populations. *Pacific Health Dialog*, 1996, **3**: 77–86.
19. **Campbell LV.** Evolution of the diabetic diet: fats and fallacies. *Asia Pacific Journal of Clinical Nutrition*, 2000, **9**: S83–S85.
20. **Hermansen K.** Diet, blood pressure and hypertension. *British Journal of Nutrition*, 2000, **83**: S113–S119.
21. **Crowley S.** *Tonga report on the economic costs of NCDs*. Nuku'alofa, Government of Tonga, 2000 (internal report).
22. *Regional plan for integrated control of cardiovascular diseases and diabetes for the Western Pacific Region, 1998–2003*. Manila, World Health Organization Regional Office for the Western Pacific, 1998.
23. *The case of mutton flaps: food dumping in the Pacific*. Wainuiomata, South Pacific Consumer Protection Programme (Internet communication, 25 October 2000 at http://www.spcpp.org.nz/articles/mutton/html).
24. **Popkins B, Koak C.** Obesity epidemic is a worldwide phenomenon. *Nutrition Review*, 1998, **56**: 106–114.
25. **Seidell JC.** Obesity, insulin resistance, and diabetes — a worldwide epidemic. *British Journal of Nutrition*, 2000, **83**: S5–S8.
26. *Obesity: preventing and managing the global epidemic. Report of a WHO Consultation on Obesity, Geneva, 3–5 June 1997.* Geneva, World Health Organization, 1997 (unpublished document WHO/NUT/NCD/98.1).
27. **Bruce S.** Prevalence and determinants of diabetes mellitus among Metis of western Canada. *American Journal of Human Biology*, 2000, **12**: 542–551.
28. **Gracey M.** Historical, cultural, political, and social influences on dietary patterns and nutrition in Australian aboriginal children. *American Journal of Clinical Nutrition,* 2000, **72**: S1361–S1367.
29. **Murphy NJ et al.** Dietary change and obesity associated with glucose-intolerance in Alaska natives. *Journal of the American Dietetic Association*, 1995, **95**: 676–682.
30. **Young TK et al.** Type 2 diabetes mellitus in Canada's First Nations: status of an epidemic in progress. *Canadian Medical Association Journal*, 2000, **163**: 561–566.
31. **Adler AI et al.** Lower prevalence of impaired glucose-tolerance and diabetes associated with daily seal oil or salmon consumption among Alaska natives. *Diabetes Care*, 1994, **17**: 1498–1501.
32. **Wein EE et al.** Nutrient intakes of a sample of First Nations adults with and without diabetes mellitus in central Alberta. *Journal of the Canadian Dietetic Association*, 1996, **57**: 153–161.
33. **Wein EE, Sabry JH, Evers FT.** Food health beliefs and preferences of northern native Canadians. *Ecology of Food and Nutrition*, 1989, **23**: 177–188.
34. **Wolever TMS et al.** Low dietary fiber and high protein intakes associated with newly diagnosed diabetes in a remote aboriginal community. *American Journal of Clinical Nutrition*, 1997, **66**: 1470–1474.
35. **Wolever TMS et al.** Low dietary fiber associated with diabetes in a remote aboriginal community in northern Ontario. *Diabetes*, 1997, **46**: 1423–1423.
36. **Beegom R, Singh RB.** Association of higher saturated fat intake with higher risk of hypertension in an urban population of Trivandrum in South India. *International Journal of Cardiology*, 1997, **58**: 63–70.
37. **Thompson SJ, Gifford SM.** Trying to keep a balance: the meaning of health and diabetes in an urban aboriginal community. *Social Science and Medicine*, 2000, **51**: 1457–1472.
38. **Thompson SJ, Gifford SM, Thorpe L.** The social and cultural context of risk and prevention: food and physical activity in an urban aboriginal community. *Health and Education Behavior*, 2000, **27**: 725–743.
39. *Policy paper addressing the health risks of the high consumption of mutton flaps in Tonga.* Nuku'alofa, Kingdom of Tonga, National Food and Nutrition Committee, 1997.
40. **Scragg R.** *Noncommunicable diseases prevention and control.* Manila, World Health Organization Regional Office for the Western Pacific, 1997 (unpublished Mission Report).
41. **Tupoulahi CS.** *The socio-cultural antecedents of obesity in Tonga* [Dissertation]. Adelaide, The Finders University of South Australia, 1997.
42. **Sheperd AW.** *Agricultural marketing in the south Pacific*. Apia, Samoa, Food and Agriculture Organization, Subregional Office for the Pacific, 1999.
43. **Fonua P.** Economy: Tonga's shrinking purchasing power. *Matangi Tonga*, 2000, **15** (3): 14–19.
44. *Quarterly foreign trade report for January–March 1999*. Nuku'alofa, Kingdom of Tonga Statistics Department, 1999.
45. *Quarterly foreign trade report for April–June 1999*. Nuku'alofa, Kingdom of Tonga Statistics Department, 1999.
46. *Quarterly foreign trade report for July–September 1999*. Nuku'alofa, Kingdom of Tonga Statistics Department, 1999.
47. *Quarterly foreign trade report for October–December 1999*. Nuku'alofa, Kingdom of Tonga Statistics Department, 1999.
48. *Annual Foreign Trade Report for 1989*. Nuku'alofa, Kingdom of Tonga Statistics Department, 1990.
49. **Bettcher DW, Yach D, Guindon GE.** Global trade and health: key linkages and future challenges. *Bulletin of the World Health Organization*, 2000, **78**: 521–534.
50. *Trading into the future: the introduction to the WTO, Members and Observers*. Geneva, World Trade Organization, 2001 (Internet communication, 9 May 2001 at http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm).
51. *Fiji lamb flap ban praised*. Honolulu, Pacific Islands Report, 2000 (Internet communication, 19 October 2000 at http://pidp.ewc.hawaii.edu/PIReport/2000/January/01-07-10.htm).
52. *Health of Fijians more important than NZ threats*. Suva, Fiji Government Press Release, 2001 (Internet communication, 9 May 2001 at http://www.fiji.gov.fj/press/2001_03/2001_03_15-01.shtml).
53. *General Agreement on Trade and Tariffs, 1947*. Geneva, General Agreement on Trade and Tariffs, 1986 (Internet communication, 9 May 2001 at http://www.wto.org/english/docs_e/legal_e/final_e.htm).