

The Seafood-Nutrition-Health Paradigm of South Pacific Islanders

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Abstract: Research was undertaken between December 2001 and July 2002 in six Tongan rural communities to clarify whether the reduced intake of fresh fish and an increased consumption of tinned fish are directly related to lifestyle disease risk. It was further investigated if the ratio of tinned to fresh fish consumption can be used as an easy-to-measure indicator of lifestyle change, and hence risk of lifestyle diseases.

The relationship between fresh fish (and seafood) and tinned fish consumption is selected as a possible proxy indicator for lifestyle and dietary changes. Obesity is used as an indicator of lifestyle disease risk and/or occurrence.

Significant differences are found between the six data sets regarding quantities of fresh fish and tinned fish consumption. However, no significant variation is found between villages in the levels of obesity.

The results of this survey clearly highlight that neither fresh fish (seafood) nor tinned fish consumption significantly relates to obesity. It is therefore concluded that assessing fresh and tinned fish intake only is not sufficient to identify changes in lifestyle, which are associated with increased risks of lifestyle diseases. (PHD 2004 Vol 11 No 1 Pages 6 - 11)

ORIGINAL PAPERS

Introduction

Traditional diets based on inshore subsistence fisheries is still regarded essential to the health, culture and economic welfare of rural people in most Pacific nations (Zann & Vuki 2000). This statement is highlighted by the fact that village level fisheries provided for 61-65% of the protein supply (Veitayaki 1993). However, imported foodstuffs (of low nutritional value) make up the major total percent of imports of most nations, and have led to western dietary diseases (Coyne 1984). This trend has increased to the effect that the people of the Pacific are currently experiencing some of the highest rates of lifestyle diseases, such as obesity and type 2 diabetes, in the world (Coyne 2000). The major risk factors for these diseases have long been recognised as being lifestyle-related. Poor diets, low activity levels, use of tobacco and alcohol are all key risk factors (WHO 1990). In the Pacific all of these risk factors have been increasing. Diets are changing, from the traditional that was high in fresh fish, local starchy staples and local fruits, towards one that is heavily reliant on imported foods (Coyne 2000). In particular

food items such as tinned meats, tinned fish, rice, sugar and salt have become regular purchases for many Pacific households. This shift in food consumption has resulted in diets that are often higher in fat, sugar and salt than are recommended, while being low in certain key nutrients such as iron and Vitamin A (Coyne 2000). In Tonga, high consumption of mutton flaps (fatty off-cuts), along with overall large portion sizes is seen as a key problem in the development of obesity and other lifestyle diseases (Englberger et al. 1990, Englberger 1983). In a recent study of dietary patterns in Tonga mutton flaps were eaten an average 2.3 times and fish 2.6 times per week (Evans et al. 2001).

Both longitudinal and cross-sectional studies of anthropometric changes have clearly shown that modernisation and Western-influenced lifestyles sustain patterns of significant weight gain in Pacific peoples (Baker, Hanna & Baker 1986; Friedlaender 1987).

A food consumption survey of urban and rural Tongans in 1973 (Finau, Prior & Maddill 1987) showed that fresh fish, shellfish and tinned fish consumption between the two settings were significantly different with the rural community consuming more fresh fish and shell fish but less tinned fish.

This paper looks at research undertaken in Tonga which allowed the exploration of two issues: is the reduction

in intake of fresh fish and the increase in consumption of tinned fish a direct contributor to lifestyle disease risk; and, can the ratio of consumption of tinned to fresh fish be used as an easy-to-measure indicator of lifestyle change, and hence risk of lifestyle diseases.

Method and survey population

The methodology used is based on the assumptions that (a) high canned fish consumption reflects a change from a traditional to a more western lifestyle as it requires less effort in supply and preparation, and is a financially attractive alternative to fresh fish. And (b) obesity is a lifestyle disease, which is more likely to occur with major changes from a traditional to a more "westernised" lifestyle, including dietary changes.

Consequently, the relationship between fresh fish (and seafood) and canned fish consumption (by quantity or frequency) is selected as a possible proxy indicator for lifestyle and dietary changes. Also, if the level of fish (and seafood) consumption plays a major role in determining nutritional-health, a strong relationship between fresh fish and seafood intake and the occurrence of obesity would be expected. Obesity is used as an indicator of lifestyle disease risk/occurrence as it is the most easily assessed in the field, and it is one of the most common forms of lifestyle disease found in Tonga (Coyne 2000).

Data collected on consumption patterns includes fresh fish consumption (quantity and frequency), seafood consumption (frequency), and canned fish consumption (quantity and frequency). The ratio between canned and fresh fish consumption (quantity) is used to characterise the degree of "westernisation" and thus change from traditional diet. Data collected in relation to the obesity occurrence are weight and height, to calculate weight status index (BMI), an indirect way of measuring fat in the body. Age and gender were also recorded.

Survey population

Between December 2001 and July 2002, a total of 362 individuals aged over 15 years, male and female, were studied in six villages of Tonga, namely Koulo and Lofanga on Ha'apai, Mataika and Ovaka on Vava'u, and Ha'atafu and Manuka on Tongatapu. Data collected in each of the six villages surveyed represents between 22.4% and 57% of target population (Table 1). Data analysis followed standard procedures of one-way analysis of variance (ANOVA) and linear

Table 1: Percentage of people surveyed per village by gender

	total number surveyed	total population ≥ 15 years	% surveyed of total population ≥ 15 years	number males survey	% males surveyed	number females surveyed	% females surveyed
Koulo	82	146	26	38	46	44	54
Lofanga	48	114	42	20	42	28	58
Mataika	76	339	22	31	41	45	59
Ovaka	37	65	57	20	54	17	46
Manuka	54	193	28	22	41	32	59
Ha'atafu	65	135	48	32	49	33	51

correlation analysis (Pearson, paired student test of results) using Excel software.

Results

Table 2: ANOVA for comparison of all 6 data sets per each village

	d.f	F	P	significant level
Age	5	2.219199	0.051896	n.a.
Gender	5	0.448198	0.814553	n.a.
BMI	5	2.647072	0.022898	n.a.
Fresh fish consumption g/week	5	9.475261	1.68E-08	***
Canned fish consumption in g/week	5	3.664064	0.003018	***
Frequency of fresh fish consumption days/week	5	21.83312	4.18E-19	***
Frequency of canned fish consumption days/week	5	6.671021	5.86E-06	***
Frequency of seafood consumption days/week	5	39.66617	1.95E-32	***

As shown in Table 2 similarities and variations between sites and populations sampled support the basic requirements of research hypothesis. All six Tongan communities surveyed show similar and thus comparative profiles as far as age and gender distribution are concerned. The same is also true for BMI data. However, there were significant differences between all six villages in the quantities of fresh fish and canned fish consumed (g/week) and in the frequencies of fresh fish, canned fish and seafood intake (days/week) (Table 3). In general, fresh fish consumption is high, however, average per capita consumption figures vary from 1.20kg/week in Ha'atafu

the relationship between fresh fish (and seafood) and canned fish consumption (by quantity or frequency) is selected as a possible proxy indicator for lifestyle and dietary changes.

Table 3: Average consumption (kg/week) of fresh fish and canned fish of all six Tongan village populations surveyed

Island group Village	Ha'apai		Vava'u		Tongatapu	
	Koulo	Lofanga	Mataika	Ovaka	Ha'atafu	Manuka
All people surveyed						
Mean fresh fish consumption	3.25	3.48	1.86	2.35	1.20	1.71
SE	0.36	0.48	0.21	0.24	0.14	0.21
Mean canned fish consumption	0.39	0.39	0.39	0.24	0.23	0.24
SE	0.06	0.06	0.04	0.04	0.03	0.03
All females surveyed						
Mean fresh fish consumption	3.19	2.79	1.45	1.93	1.21	1.58
SE	0.56	0.55	0.21	0.37	0.22	0.33
Mean canned fish consumption	0.37	0.40	0.44	0.20	0.23	0.24
SE	0.08	0.08	0.05	0.05	0.05	0.04
All males surveyed						
Mean fresh fish consumption	3.31	4.44	2.46	2.70	1.19	1.86
SE	0.45	0.81	0.39	0.30	0.17	0.24
Mean canned fish consumption	0.43	0.37	0.33	0.27	0.23	0.25
SE	0.08	0.07	0.05	0.06	0.03	0.04

village on Tongatapu to 3.48 kg/week in Lofanga village on Ha'apai. Similarly, canned fish consumption varies between 0.23 (Ha'atafu) and 0.39 kg/week/head (Koulo, Lofanga and Mataika). The range of average fresh fish consumption in kg per female per week ranged from 1.21 (Ha'atafu) to 3.19 (Koulo), while amongst males from 1.19 (Ha'atafu) to 4.44 kg/week/per head (Lofanga).

The range of average fresh fish consumption observed between villages on Ha'apai, Vava'u and Tongatapu suggests that this may reflect an urbanisation gradient. Highest consumption figures are found in the relatively isolated Ha'apai group, and lowest in the most urbanised Tongatapu region.

Analysing all the data by gender (Table 4) reveals

Table 4: ANOVA all data per gender group (women-men)

	d.f.	F	P	Significant level
Age	1	1.122071	0.290173	n.a.
BMI	1	45.61082	5.7E-11	***
Fresh fish consumption g/week	1	2.054334	0.15262957	n.a.
Canned fish consumption in g/week	1	0.073041	0.787113	n.a.
Frequency of fresh fish consumption days/week	1	0.439353	0.507853	n.a.
Frequency of canned fish consumption days/week	1	3.822738	0.051324	n.a.
Frequency of seafood consumption days/week	1	0.042694	0.836417	n.a.

that BMI is significantly different between the female and male population. All other parameters however, are similar and comparative (age, fresh fish, canned fish and seafood consumption patterns).

No linear correlations (Pearson) were found between obesity (BMI) and any of the other parameters assessed. Highly significant linear correlations were found between BMI and gender, and BMI and age only. Pearson results were all positively t-tested. The relationship between age and BMI is highlighted in Figure 1 for women and Figure 2 for men. BMI is seen to increase with age in both genders.

Tables 5 and 6 show further evidence of the links

Table 5: Linear relationships between parameters using all data

	<i>r</i>	significant level	<i>t-test</i>	significant level
BMI – gender	0.390392	***	85.42016	***
Age-BMI	0.222781	***	8.624375	***

Table 6: Distribution of obese, overweight and normal weight men and women in percent

Village	Koulo		Lofanga		Mataika		Ovaka		Manuka		Ha'atafu	
	<i>No</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%
MALE												
Obese	10	26	5	25	8	26	4	20	2	9	16	50
Overweight	16	42	6	30	12	39	8	40	7	32	8	25
Normal weight	12	32	9	45	11	36	8	40	13	59	8	25
Total	38	100	20	100	31	100	20	100	22	100	32	100
FEMALE	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%	<i>no</i>	%
Obese	35	80	20	71	32	73	11	65	17	53	23	70
Overweight	7	16	6	21	10	23	5	29	10	31	9	27
Normal weight	2	5	2	7	2	5	1	6	5	16	1	3
Total	44	100	28	100	44	100	17	100	32	100	33	100

Table 7: Selected nutritional values of fish products (in units per 100g of fish)

	Water g	energy Kcal	protein g	total fat g	CHO avail. g	dietary fibre	Cholesterol mg	sodium mg
Tuna canned oil drained	62	221	24.4	13.7	0	0	40	441
sweetlip, raw	78	83	19.8	0.2	1	0	n.a.	84
snapper, steamed	73	121	24.2	2.7	0	0	89	102
tuna canned oil	57	92	20.8	23.2	0	0	33	417

between gender and obesity rates. Between 9-50% of males were found to be obese whereas the range for females was 63-80%. This meant that only between 3-16% of women were classed as normal weight, whereas 31-59% of men were normal weight.

Discussion

Seafood consumption patterns are similar between gender groups surveyed. This result suggests that culturally all six Tongan communities still follow the traditional styles of preparing and sharing food amongst all members of the household or family.

Significant differences exist between the six village data sets in regard to quantities of fresh fish and canned fish consumed, and frequency of fresh fish, canned fish and seafood intake. However, no significant variation is found between villages in the levels of BMI and of obesity.

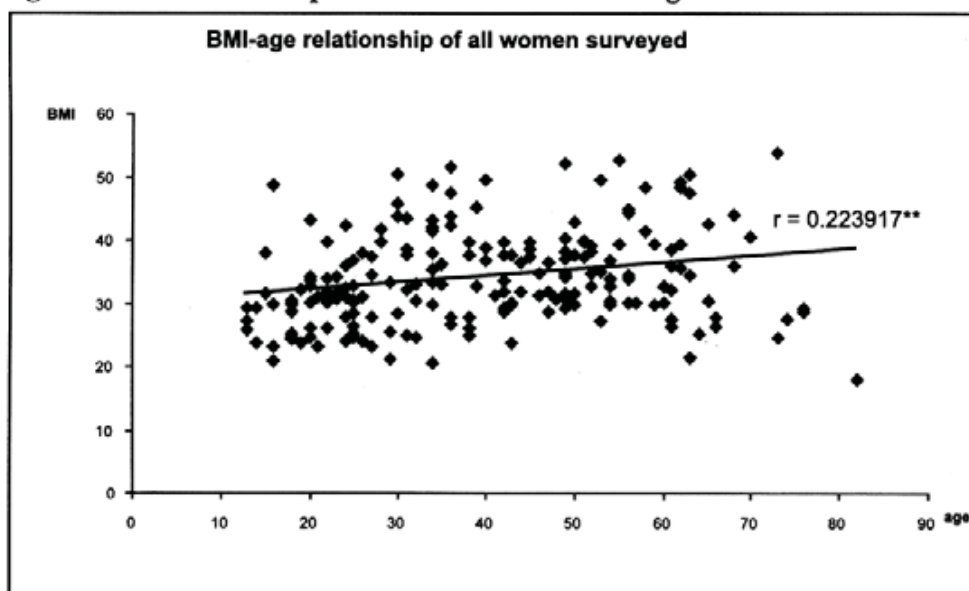
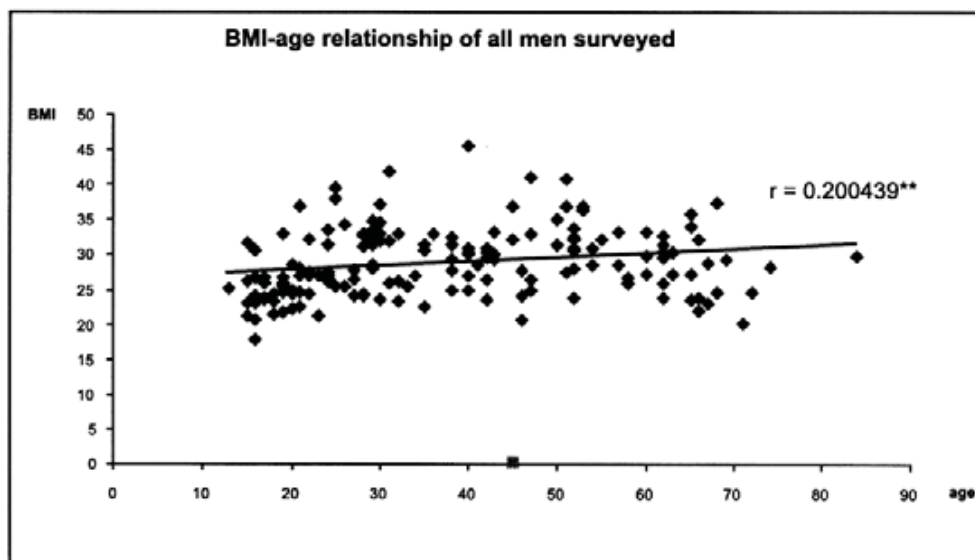
The results of this survey clearly highlight that neither

fresh fish (seafood) nor canned fish consumption significantly relates to BMI. The results do show significant relationships between BMI, age and gender (in line) consistent with other data available. Women show higher rates of obesity in Tonga and throughout most of the region, and rates of obesity increase with age (Coyne 2000).

Based on the findings of this study, two major conclusions can be drawn:

- 1) Fish and seafood consumption patterns are not causally linked with the development of obesity (or other lifestyle diseases);
- 2) The replacement of fresh fish by tinned fish does not accurately reflect changes in lifestyle from traditional to more western, and as such cannot be used as a proxy indicator of the risk of development of lifestyle diseases.

Canned fish has a fairly similar nutrient content to fresh

Figure 1: Relationship between BMI and age of all women surveyed**Figure 2: Relationship between BMI and age of all men surveyed**

fish and therefore is unlikely to be causally linked with any lifestyle disease (see Table 7). Although the way of using fresh and tinned fish could be significant e.g. an increase in oil consumption if canned fish in oil is consumed undrained, loss of possible nutrients which would be gained by eating the liver of fresh fish.

Conclusions

In conclusion, the results demonstrate that beliefs held by individuals regarding the risks of consuming tinned fish instead of fresh fish are unfounded, and that no direct link exists. This also means that just assessing fresh and tinned fish intake is not sufficient to identify the changes in lifestyle, which are associated with increased risks of lifestyle diseases.

As demonstrated by Coyne (2000) prevalence of chronic degenerative diseases as diabetes, hypertension, ischaemic heart disease and cancer is low among people living a traditional life style. A traditional lifestyle must therefore encompass more indicators than just one food type (i.e. fresh fish versus canned fish). Many aspects of the change from traditional to less-traditional lifestyle are important factors in the increased risk of lifestyle-diseases, such as intake of fruits and vegetables, intake of root crops, use of alcohol and cigarettes, and physical activity (Coyne 1984).

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the results demonstrate that beliefs held by individuals regarding the risks of consuming tinned fish instead of fresh fish are unfounded

I eat to live, to serve, and also, if it so happens, to enjoy,
but I do not eat for the sake of enjoyment
(Mahatma Gandhi)