

Nutritional study of the Islanders on Tristan da Cunha, 1966

1. The foods eaten by Tristan Islanders, their methods of preparation and composition

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1. A description of the population resident on Tristan da Cunha during the winter of 1966 is given.
2. Sources of food supplies are discussed.
3. A brief description of island meal patterns is given and methods of food preparation are discussed.
4. Samples of unusual foods and unique dishes consumed on Tristan da Cunha were collected and analysed for moisture, total nitrogen, fat, calcium, iron and ascorbic acid.
5. The dietary patterns and way of life of the Islanders resident on Tristan da Cunha have changed owing to contact with the outside world and to the development of a monetary economy. These changes were accelerated by the enforced period of 2 years spent in England. The Islanders are now very dependent upon a cash economy and subsistence agriculture provides only a relatively small part of the present diet.

In 1961 the Islanders of Tristan da Cunha were evacuated when a volcano erupted beside their village settlement. They were brought to England, where the majority remained for almost 2 years (Lewis, 1963). In July 1963, 4 months before they left to return home, the weekly food intake of thirty-seven families was measured (Taylor, Hollingsworth & Chambers, 1966). As a result of this survey the Medical Research Council Working Party on Tristan da Cunha decided that a further nutritional study of the Islanders was desirable once the community had settled down again to its traditional mode of life on the island, and that this study should be combined with measurements of energy expenditure and continuing anthropometric studies.

One of us (M. A. C.) lived on the island from April to October 1966, and this paper is one of a series describing the results of studies made.

The nutrition of the Islanders represents some unique features and it is important to review the supplies of food available and methods of food preparation. The present paper describes the food eaten by the Islanders, their method of preparation and chemical composition.

EXPERIMENTAL

Population

There were 228 Islanders on Tristan da Cunha in 1966, living in sixty household units. Table 1 shows the distribution of age and sex in the population.

Food supplies

Island produce. The island is about 11 km (7 miles) in diameter, but the inhabited part is barely 7.8 km² (3 sq. miles). The settlement plateau is about 7.2 km (4.5 miles) long and up to 0.8 km (0.5 miles) wide. Some of this is occupied by buildings of the village and by debris from the volcanic eruption (Gass, 1962).

Potatoes are the only crop produced on Tristan in any quantity. They are grown on an area of about 14 hectares (35 acres). The soil is a sandy loam and has provided reasonable yields of potatoes for more than 100 years. All Islanders grow some vegetables, pumpkins and cabbage being the most common. An uncultivated island berry (*Empetrum rubrum*) is collected from the sides of the mountain during the first few months of the year. These and some apples are the only fruits available.

There are about 300 cattle on Tristan, of which 100 are kept in a semi-wild state and are used only for meat. The remainder, together with some 150 sheep and 70 donkeys, are kept on the settlement plateau. Poultry are kept by most Islanders but few eggs are produced except in the spring.

Table 1. *Tristan population, 1966: age and sex distribution*

Age (years)	Males	Females
61 and above	12	13
51-60	11	10
41-50	17	12
31-40	22	16
21-30	15	20
15-20	16	10
10-14	4	10
5-9	7	15
0-4	6	12
Total	110	118

Fish is caught throughout the year whenever sea conditions are suitable. It forms an important part of the diet, contributing about 20% of total protein intake.

The flesh of young sea-birds is used during the later summer and sea-bird oil is an important source of fat. Sea-bird eggs are sometimes obtained during the spring.

Imported foods. Though home-produced food still forms the basis of the diet, the contribution of imported processed foods is substantial. Cash slips of sales to each family were obtained for the month of August and the average quantity purchased per head per day in each family was calculated. The average quantity purchased for the total population was then determined. Table 2 shows the types and quantities of foods purchased per head of the population, together with the number of households purchasing each item. In addition, approximate quantities purchased of beer, spirits and chocolate were determined from a rough stocktaking for the period May-September. These items are normally obtained from the bar, where no record of sales is kept.

A household food consumption study was undertaken on the island between 1964 and 1966, and records of foods consumed by those households who took part were compared with food purchases made in August 1966. Purchases of sugar were 300 g

per head per week greater than quantities consumed, and purchases of preserves, canned vegetables, canned meat, dried and canned fruit were twice as large as quantities consumed; more flour was purchased than used. The Tristanians tend to hoard food supplies obtained from the island store, as they have learned from past experience that insufficient quantities are sometimes ordered from the mainland and they have become so dependent on processed foods that great care is taken to maintain adequate larder stocks.

Table 2. *Household food purchases from the island store in August 1966*

Commodity	No. of households purchasing*	Mean daily purchase (g/head)	Coefficient of variation
Flour	60	179	37
Sugar	60	133	38
Evaporated milk	59	54	29
Biscuits	59	20	56
Jam/jelly/syrup	59	20	58
Other cereals	58	34	73
Canned meat/fish	56	28	90
Canned fruit	56	20	78
Dried fruit	54	11	72
Canned vegetables	54	23	74
Fat	52	14	65
Cocoa/chocolate/sweets	47	6	85
Canned soup	43	6	105
Chutney/sauces	43	6	57
Cream/cheese	39	6	100
Sherry	37	14	192
Dried milk	17	11	160
Approximate purchases from island bar			
Spirits	—	17	—
Beer	—	28	—
Chocolate	—	28	—

* Total number of households = 60.

Methods of food preparation

Tristan families have similar meal patterns. Breakfast is a light meal and, apart from porridge, a cooked dish is rarely consumed; lunch is usually a one-course meal of potato and meat, fish or eggs on week-days, with canned fruit or pudding in addition at the week-end. The evening meal follows a similar pattern, but rice, bread and pancakes are alternative dishes. Tea, coffee or cocoa are taken at frequent intervals and snacks of biscuits and cakes are popular with the younger Islanders.

Methods of cooking are restricted to a certain extent by the types of heating available, most homes having an open fire burning the island tree (*Phyllica arborea*) and a paraffin stove. Portable ovens are shared between friends.

The methods of preparation are similar to those used in traditional British cooking, though with greater reliance placed on stewing, boiling and pot-roasting. Home baking is widely practised, which is in marked contrast to the pattern observed when the Islanders were in England. The recipes used for cakes are often eggless and bear a

resemblance to recipes used in Britain during war-time rationing. Soft cake resembles a Victoria sandwich cake, though cooking oil is the fat of choice; hard cakes are scones. Black cake is an eggless, rich fruit-cake and chocolate cakes are made from two recipes, one with eggs and the other without. Doughnuts are made from flour, baking powder, sugar and cooking oil. They are made into a stiff dough, rolled into balls and fried in deep fat. Snuislings are made from flour, baking powder and cooking oil. Slices of dough about 1 cm thick are fried in deep fat. They are eaten hot or cold with sugar, jam or syrup.

Potatoes are still eaten with most main meals. They are served in a variety of ways. Plain boiled potatoes are generally cooked in their skins, but when incorporated in a dish such as a stew they are peeled before cooking. Vegetables are usually added to stews or soups with the exception of pumpkin, which is eaten boiled, fried or in a pie.

Meat is pot-roasted if tender, but is more often stewed. Roast meat is usually stuffed with potato stuffing. Fish is eaten boiled or fried, though it is sometimes incorporated in soup or hash. Comparison of the recipes for potato dishes eaten on the Island in 1937 (Henriksen & Oeding, 1946) and in 1966 shows that flour has taken the place of part of the potato used in some dishes, such as Tristan plum potato pudding, potato cakes and berry pie, but broadly speaking there seems to have been little change in the recipes or method of preparation.

Food composition

Food sampling and storage. Whilst the foods eaten by the Tristan Islanders comprised many items whose composition was well known, their diet also included many unusual foods and unique dishes. Samples of these foods were collected throughout the study. As the Islanders refused to save portions of their meals for analysis, two girls were employed to cook the necessary material. One was an experienced cook, the other less experienced, but it was felt that the results obtained from the combination of foods prepared by the two cooks provided a reasonable approximation for the dishes prepared by the Islanders as a whole.

The foods and dishes were homogenized, and representative portions were stored in polythene bottles in a deep freeze (-20°). Samples for the determination of ascorbic acid were placed in 6% (w/v) metaphosphoric acid and homogenized before being stored at -20° . The samples were brought to England for analysis.

Analytical methods

Moisture. Moisture was measured by drying portions of the food to constant weight in an air oven at $98-100^{\circ}$.

Protein. Total nitrogen was measured by the micro-Kjeldahl technique following the recommendations of Chibnall, Rees & Williams (1943). Protein was taken as $N \times 6.25$ for all foods except cereals, when $N \times 5.7$ was used.

Fat. Fat was measured in all foods derived from animal sources by a modification of the method of von Lieberman & Szekely (1898) and Southgate & Barrett (1966). Fat in other foods was measured after extraction by chloroform/methanol (D. A. T. Southgate, in preparation).

Carbohydrate. In foods containing little or no unavailable carbohydrate (McCance & Lawrence, 1929), the carbohydrate was measured by difference. In foods containing unavailable carbohydrates, available carbohydrates were measured using the procedure proposed by Southgate (1964).

Ash. Ash was measured after heating the dried food in an electric muffle furnace at 475° overnight or until a carbon-free ash was produced.

Inorganic constituents. An ash extract was prepared following the method of McCance, Widdowson & Shackleton (1936); calcium was measured by atomic absorption spectroscopy and iron by reaction with *o*-phenanthroline (Sandell, 1959).

Calorific values. These were calculated by use of the factors 4.0 kcal/g protein, 9.0 kcal/g fat, 3.75 kcal/g available carbohydrate expressed as mono-saccharides and 4.1 kcal/g carbohydrate by difference (Widdowson, 1955, 1960).

Ascorbic acid. This was estimated in most samples by visual titration with 2:4 di-chlorophenol indophenol according to the method described by the Association of Vitamin Chemists (1951). True ascorbic acid in samples of the red island berry was estimated photometrically after reaction with 2:4 dinitrophenol hydrazine and separation by thin-layer chromatography as described by Strohecker & Henning (1965)."

RESULTS

The results obtained on the samples of food collected during the study are presented in four tables, dealing respectively with fish foods and products, sea-birds and their products, vegetable and fruit dishes, and meat and other prepared dishes. Items of food for which analytical values were available were not sampled for analysis.

Table 3 shows the results obtained with the fish and fish dishes. The fish was analysed both in the raw and cooked state but in all instances only edible material was analysed. The results indicate that the majority of fish eaten on Tristan are of the non-fatty variety, the exception being the one yellow-tail caught during the study. The values obtained were similar to those reported for other kinds of fish (McCance & Shipp, 1933). Those fish with very fine bones tended to have higher concentrations of calcium than those whose bones could be removed with more certainty.

Table 4 gives the results obtained with the sea-birds and their eggs and oil. The flesh of the two birds contained more fat and iron than the raw chicken muscle analysed by McCance & Widdowson (1960), and the composition of these two meats is closer to the values reported for birds that still possess the ability to fly, although the iron values found were only half those reported for pigeon flesh by McCance & Widdowson (1960). The eggs from the albatross and penguin were similar in gross composition, and contained more water and less fat and protein than the egg of the domestic hen (McCance & Widdowson, 1960). The calcium values were similar to those found in the hen's egg, but the penguin's egg contained very much more iron. The composition of the oils presented no unusual features although their fatty acid composition is probably quite different from the cooking oils used in most western countries.

Table 5 gives the composition of the vegetable and fruit dishes characteristic of the

Table 3. *Composition of fish and fish dishes (per 100 g edible portion)*

Fish	Method of preparation	Moisture (g)	Protein (N × 6.25)		Carbo- hydrate (g)	Ash (g)	Ca (mg)	Fe (mg)	Calorific value (kcal)
			(g)	(g)					
Bluefish (<i>Seriolella antarctica</i>)	Raw	78.9	20.1	0.5	—	1.3	9	0.5	85
	Boiled	72.5	26.5	0.8	—	1.3	15	0.6	113
	Fried	71.7	23.3	5.3	—	1.3	14	0.5	141
	Hash	72.9	9.4	4.8	11.5	1.6	8	0.7	128
	Soup	83.1	7.5	0.2	8.2	0.9	6	0.7	63
	In fish cakes	63.0	8.7	9.1	17.6	1.6	9	0.8	188
Fivefinger (<i>Acantholatris monodactylus</i>)	Raw	79.6	19.9	0.4	—	1.1	24	0.5	84
	Boiled	77.4	21.3	0.8	—	1.4	35	1.1	92
	Fried	69.2	24.1	6.0	—	1.3	9	0.8	150
	Fried in batter	60.9	18.8	12.6	5.4	2.2	13	0.8	211
Soldier fish (<i>Sebastichthys capensis</i>)	Raw	79.4	20.0	0.6	—	1.3	70	0.6	85
	Boiled	73.0	22.6	1.9	—	2.3	72	1.0	108
	Fried	57.3	32.4	9.3	—	3.3	69	1.1	213
Snoek (<i>Thyrsites atun</i>)	Raw	75.2	24.5	0.4	—	1.4	16	1.0	102
	Steamed	71.2	28.0	0.7	—	1.3	21	1.1	118
Steambras	Raw	76.3	22.3	3.2	—	1.3	39	0.7	118
	Fried	69.3	24.4	5.4	—	1.3	26	0.6	146
	Hash	73.4	7.7	4.6	12.7	1.6	23	0.5	125
Crawfish (<i>Jasus lalandii</i>)	Raw	79.8	19.6	0.6	—	1.8	25	0.8	84
	Boiled	71.6	26.8	0.7	—	1.3	23	1.6	114
	Fried	43.4	25.4	21.2	—	2.2	30	0.8	292
	Hash	72.1	6.6	7.8	11.7	1.9	13	0.7	144
	Mayonnaise	59.1	19.9	15.7	3.5	1.7	37	0.6	236
Yellow-tail	Raw	56.7	17.9	26.3	—	1.5	22	0.5	308

Table 4. *Composition of sea-birds and derived products (per 100 g edible portion)*

Food	Material analysed	Moisture (g)	Protein (N × 6.25)		Fat (g)	Ash (g)	Ca (mg)	Fe (mg)	Calorific value (kcal)
			(g)	(g)					
Albatross (<i>Diomedea chlororhynchos</i> and <i>Phoebetria fusca</i>)	Raw, breast and leg	73.2	20.9	6.1	—	1.0	5	3.7	139
	Roast, breast and leg	49.3	24.7	21.4	—	1.2	8	4.3	291
Shearwater (<i>Procellaria gravis</i>)	Raw, salted leg	63.7	20.7	8.7	10.9	24	4.0	162	
	Boiled, leg	66.3	23.5	9.0	2.2	11	3.8	175	
Eggs:*									
Albatross	Raw	77.7	10.8	8.6	0.9	41	2.6	121	
Penguin (<i>Eudyptes crestatus</i>)	Raw	78.5	9.8	9.5	1.0	52	4.7	124	
Oils:									
Albatross	—	tr	tr	99.9	—	tr	tr	899	
Shearwater	—	tr	tr	99.9	—	tr	tr	899	

tr, Traces.

* Contained very small amounts of carbohydrate.

Tristan diet. Most potatoes grown now are of a variety imported since the return to the island. Stocks of 'smooth skin' potatoes, grown before the eruption, are gradually being rebuilt. A sample of both potatoes was analysed. In composition, island produce

resembles the potato eaten in the United Kingdom; the concentration of calcium is, however, slightly lower and the values for iron slightly higher. The concentration of ascorbic acid was quite low in the potatoes sampled in April and, on the basis of the

Table 5. *Composition of vegetable and fruit dishes (per 100 g edible portion)*

Food	Material analysed	Moisture (g)	Protein (N × 6.25) (g)	Fat (g)	Carbo-hydrate (available) (g)	Ash (g)	Ca (mg)	Fe (mg)	Ascorbic acid (mg)	Calorific value (kcal)
Potato	Raw (peeled)	77.1	1.9	ND	20.0	ND	ND	ND	13 (April) 8 (Oct)	88
	Boiled	74.1	2.2	Trace	20.7	1.1	2	0.7	4 (with skin) 3 (without skin)	86
	'Smashed'	74.5	2.2	5.7	15.5	1.6	18	0.7	1	118
	Fried	54.1	3.8	6.0	34.5	1.6	2	2.1	6	210
	Roast	58.8	3.4	2.6	33.7	1.5	3	1.4	6	175
	Cakes	42.6	5.4	7.7	43.4	0.9	6	1.1	1	269
Tristan plum potato pudding		54.4	4.2	0.4	40.0	1.0	7	1.4	1	185
Pumpkin	Fried	79.8	Trace	10.1	6.4	2.9	15	0.6	3	117
	Pie	56.0	4.0	5.3	34.0	0.8	12	1.4	1	203
Cranberry	Raw	89.6	Trace	Trace	3.2	0.4	27	0.4	6	12
	Pie	60.3	3.2	0.3	35.8	0.5	9	0.8	3	162

ND, not determined.

Table 6. *Composition of meat dishes and other prepared foods (per 100 g edible portion)*

Dish or food	Moisture (g)	Protein (N × 6.25)* (g)	Fat (g)	Carbo-hydrate (g)	Ash (g)	Ca (mg)	Fe (mg)	Calorific value (kcal)
Steak, braised canned	75.7	18.4	1.9	2.8	1.3	5	2.4	103
Meat hash	70.0	6.7	7.1	14.3	1.9	7	1.3	149
Meat pie	75.7	7.1	2.8	13.1	1.3	4	7.5	107
Meat soup	83.2	5.6	1.0	9.0	1.3	6	1.2	68
Cake flour	15.6	8.9	0.5	74.5	0.5	14	1.6	345
Bread	40.8	6.3	0.3	52.7	1.0	9	1.2	244
Hard cakes (scones)	22.4	6.8	15.0	54.6	1.2	11	1.8	386
Sweet cakes	31.7	5.3	5.7	56.0	1.3	11	1.6	302
Soft cake (victoria sandwich)	20.9	5.8	15.1	57.4	0.8	11	1.0	394
Black cake (fruit cake)	33.2	4.0	6.0	54.8	2.0	40	2.5	295
Steamed pudding	45.6	5.1	6.6	41.7	1.0	24	1.9	250
Pancakes	45.2	4.0	14.9	35.8	0.2	7	0.9	295
Snuislings (see p. 230)	26.0	5.7	22.2	45.4	0.7	10	1.6	409
Doughnuts	27.6	5.5	17.1	49.3	0.6	9	1.0	378
Milk tart	45.5	5.3	4.8	43.5	0.9	65	1.8	243

* For foods containing flour N × 5.7.

tables given by Barrett & Widdowson (McCance & Widdowson, 1960), corresponds to potatoes stored for some 5–6 months, although they had been stored on the island only for some 2–3 months. The storage conditions are, however, poor on the island and the Islanders seem to pay little attention to them, so that it is hardly surprising that the potatoes deteriorate, as far as ascorbic acid is concerned, more rapidly than in Britain.

The pumpkin provides little vitamin C. The island berry contains only a small amount of available carbohydrate, but contains more calcium and less iron and vitamin C than the cranberry, which it resembles.

Table 6 gives the composition of sixteen prepared dishes which are characteristic of the Tristan diet. Most of them contain less fat than similar dishes in Britain. The low calcium values compared with the British counterparts are a reflection of the use of unfortified flour on the island. The bread baked on the island contains less protein than the British bread (Coppock, Knight & Vaughan, 1958; McCance & Widdowson, 1960). This is due to the use of cake flour, with its lower protein content compared with bread flours used in Britain.

DISCUSSION

The dietary patterns and way of life of the Islanders resident on Tristan da Cunha have changed since an industry became established on the island in 1949. This change was accelerated by the enforced period of 2 years spent in Great Britain following the volcanic eruption of October 1961. The changes are due to contact with the outside world and the development of a monetary economy on the island. In a subsequent paper, details of the Tristan economy and the factors affecting present conditions on the island will be discussed. It is sufficient to stress here the very great importance of imported processed foods to the island dietary. These foods have replaced island dependence on seasonal foods to a large extent and have reduced the danger of food shortages. If, however, the fishing industry were removed, great hardship might follow, since all families have become so dependent upon a cash economy that subsistence agriculture provides only a relatively small part of the present-day diet, though the greater part of the protein supplies are still home-produced.

There were few unusual features in the composition of foods unique to Tristan da Cunha; the results of analysis are presented primarily because they form an essential preliminary study to the complete account of the nutrition of the Islanders and because they may be of value to workers conducting surveys in areas where similar fish and sea-birds are consumed.

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