



# The Fruits We Eat

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SECRETARIAT OF THE PACIFIC COMMUNITY



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OF THE PACIFIC COMMUNITY

# The Fruits We Eat

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### **Autors**

1. Mele'ofa Malolo, Nutritionist, Roma Primary Health Care Unit, St George Health Services, P.O. Box 602, St George, Queensland 4487, Australia.
2. Tai'ora Matenga-Smith,
3. Jimaima Tunidau-Schultz, Lifestyle Health Adviser, Secretariat of the Pacific Community, BP D5, 98848 Noumea Cedex, New Caledonia.

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## PREFACE

This handbook briefly discusses and describes commonly available fruits in the Pacific, their nutritional value, their composition, and their non-nutritional role, which includes medicinal purposes.

In the Pacific, fruits can be classified in a number of ways, such as by variety, season, popularity and availability. The fruits covered in this handbook are classified according to their availability and use in the Pacific. They are divided into two groups: major tropical fruits —avocado, banana, citrus, coconut, mango, pandanus, pawpaw (papaya), pineapple — and minor tropical fruits, including custard apple and soursop, guava, jack fruit, jambolan, *kavika*, lychee, *nandau*, passionfruit, star fruit, tamarind, *tarawau*, watermelon and *wi*.

This handbook is intended for use by nutritionists, community nutrition and health workers, agricultural workers, health educators and others interested in nutrition and health. It can also be used as a supplement to other food and nutrition resources previously produced by SPC, such as the Pacific Food Leaflets; the first two handbooks in this series, *The Leaves We Eat* and *The Staples We Eat*; the Pacific Diet Advisory Leaflets; the USP/SPC Pacific Community Nutrition Modules and other important educational resources on food and nutrition in the Pacific.

This volume, *The Fruits We Eat*, is the third in the series of handbooks based on information provided by the Australian Centre for International Agricultural Research (ACIAR). This includes the analysis of root crops conducted by Bradbury and Holloway, which resulted in the publication *Chemistry of Tropical Root Crops: Significance for Nutrition and Agriculture in the Pacific*, in 1988. Additional analytical data were obtained from the University of the South Pacific (USP) and ACIAR Project on Nutrient Composition of some Pacific Island Foods, a joint effort of the Institute of Applied Sciences, USP, ACIAR and the Australian Government Analytical Laboratories. The information is documented in *Pacific Island Foods*, an Institute of Applied Science, USP, Technical Report written by English, Aalbersberg and Sheelings and published in 1996. The other major source of information for this manual was the joint SPC/Crop and Food Research/INFOODS publication



*Pacific Island Food Composition Tables*, 1994. Other resources used are listed in the references.

Section I of this handbook briefly discusses the role of fruit in both traditional and modern settings. Sections II and III describe the qualities and values of fruit in the diet. Descriptions of 27 common fruits grown and eaten in the Pacific are given in Section IV. Section V discusses their nutrient composition and Section VI looks briefly at the future for fruit in the region.

This handbook is not meant to be a complete book on fruits available in the Pacific, but we hope you will find it useful in your work. We also hope you will give suggestions for improving future editions.

## I. ABOUT FRUITS

Because of their warm, tropical climate, almost all Pacific Islands are blessed with a delicious abundance of tropical fruits almost all the year round. A wide variety of fruits is able to grow in an equally wide variety of conditions and in soils which are well suited to fruit. The exceptions are some of the atolls, especially in Micronesia.

Traditionally, fruit is considered a supplementary part of the Pacific Island diet. However, our knowledge of nutrition and food values has shown that consumption of fruit plays an important role in the nutritional well-being of Pacific Island people.

### Fruits in the traditional world

Traditionally, fruits do not have the same status in the Pacific as the starchy root staples. They were usually eaten as snacks when out garden-ing in the bush or when at home. Some were used as flavourings or sweetening agents in traditional island puddings. Apart from the coconut, it is said that the only other fruit that was of importance in the Pacific in early times was the pandanus fruit (Hiyane, 1971). The fruit of this palm-like plant of the Pandanaceae family is still commonly eaten in many of the Polynesian and Micronesian atolls.

Baiteke (1990) refers to the newer introduced fruits as 'lacking in the quality characteristics of the old world association, as opposed to the old world plants such as coconut and pandanus which are full of history, magic and superstition'. She describes one of the many I-Kiribati traditional associations of *te ni* (the coconut) and *te kaina* (pandanus) in the following story about a boy who fell in love with a beautiful girl, and describes the uses for *te kaina* (pandanus).

#### Te ni (coconut)

This story is about a boy who fell in love with a beautiful girl. The girl's parents did not approve of the match. The boy pined away and died, but before







he died, he told the girl to remove his skull and plant it beside her house. This she did. From the skull grew a plant that became a coconut tree. When the girl was thirsty, the green coconut was prepared for her to drink and thus she was united with her boyfriend. A husked green coconut has two eyes and a mouth.



### Te kaina (**pandanus**)

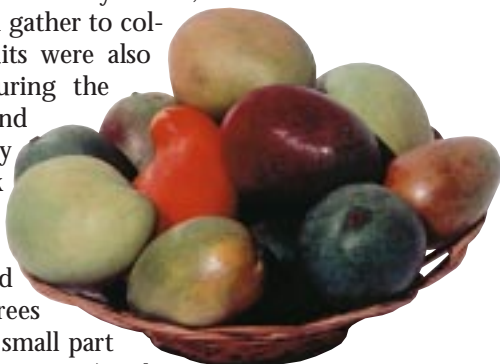
This is another important tree for its timber, leaves and fruits. The preserved fruit in the form of *kabubu* and *tuae* were used in the ancient days as food for long voyages. The leaves are sewn together for thatching houses. A dwelling house should always be thatched with pandanus leaves, not coconut leaves. Pandanus thatch (*te rau*) brings peace to the occupants. In the *maneaba* (meeting house), it will be noticed that a collection of three leaves will be hanging above the visitor's *boti* (seat). The collection consists of the leaf of *te mai* (*mai* means 'welcome home'), a dry coconut leaf (means 'to come inside'), and a pandanus leaf (means 'peace'). The significance of the three leaves is 'Welcome! May peace be with you'. (Baiteke, 1990).

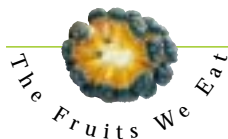
Fruits were also used for certain ceremonial occasions. An example of the latter is the thanksgiving ceremonies held by some Island churches. This thanksgiving custom was probably a tradition that the early missionaries incorporated into the new religion. The first harvests of fruits, staple crops or flowers were displayed in the churches during the course of the year. These thanksgiving ceremonies symbolise successful harvests made possible through God's blessing. After the church service, the foods are



then donated as gifts to the pastor or priest. If there is an abundance of foods, they may also be given to various community groups and hospitals.

In some parts of the Pacific, particularly in Melanesia, gathering of fruit and nuts was an important cultural activity in the community. When seasonal fruits, such as mangoes, were ready to eat, women, men and children would gather to collect and eat the fruits. The fruits were also shared around the villages. During the early mango season, women and children would get up in the early hours of the morning to pick those that had fallen on the ground during the night. Today, with increased affluence and dependence on cash, most fruit trees are harvested for sale and only a small part (in some cases, over-ripe fruits or rejects) is kept for domestic use.





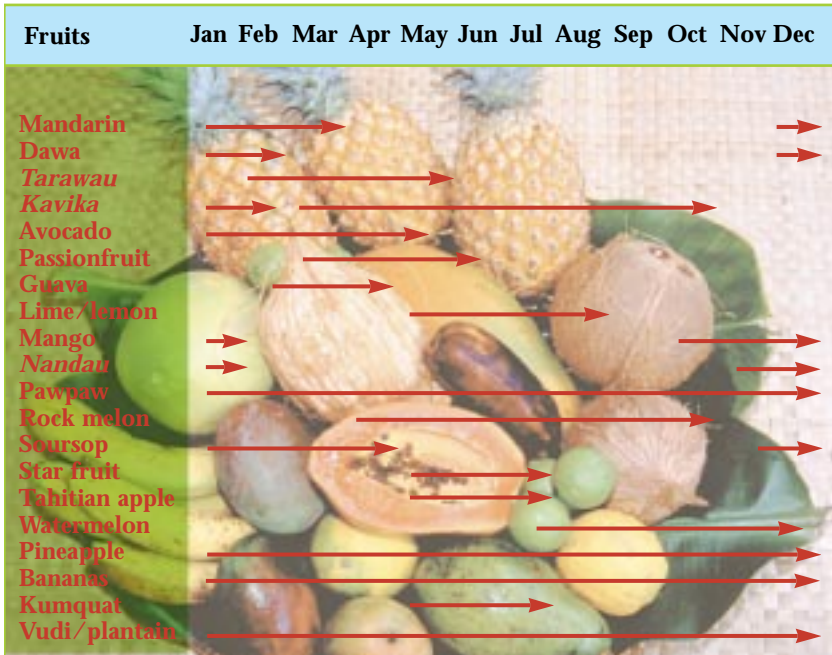
## Fruits today

The majority of fruits available in the Pacific today have been introduced from elsewhere during the great voyages of discovery and exploration (Samson, 1986; Stanton, 1986). In the past, most fruits were harvested and shared amongst families and groups within the community. Some of the older fruits, such as pandanus and bananas, were preserved, then used in puddings. For example, in Kiribati, pandanus were preserved as *tuae* and then used to make *roro*, a sweet cake.

Fruit can be defined in various ways. Botanists see fruit as ‘the developed ovary of a flower after fertilisation has taken place’ (Samson, 1986). Some fruits, however, develop without fertilisation and do not contain seeds. Horticulturists define fruit as ‘something which is eaten fresh and out of the hand’. Nutritionists in the Pacific view fruit as a healthful, protective food, containing a number of essential nutrients, such as Vitamin A, Vitamin C, minerals, carotene and dietary fibre (Dignan et al., 1994).

Fruits vary in flavour and availability, depending on seasonal, climatic, geographical, environmental, and social and economic factors. Because most fruits are seasonal, different fruits are available at different times of the year. Seasonal availability of the same fruit may differ from island to island. Figure 1 illustrates the fruit seasons in Fiji Islands as an example. The seasons for the fruits shown may be different from those in your island. This is normal, because of the variations in climate, topography, geography, and soil conditions. In some parts of the Pacific there can be a serious shortage of fresh fruits at certain times of the year. On some islands with poor soil, fruits may not be grown successfully in adequate quantities to maintain a steady supply for the ever-increasing population.

Sunlight and water are necessary for growth of all plants, especially those that bear fruit. Fruits such as bananas and pawpaw grow best when rainfall exceeds 100 millimetres each month. This is not always possible, as some parts of the Pacific experience drought periods from time to time. Other fruits, such as mangoes, need more dry months to fruit and ripen properly.



**Figure 1: Fruit availability in Fiji**  
 (Source: Fiji National Nutrition Committee, 1999)

However, with advances in science and technology, new varieties of fruits have been developed. In addition, some fruits and vegetables can now be grown in man-made environments.

Most of the major tropical fruits grown in the Pacific are readily available in island markets when in season. Local fresh fruits sold in markets, stores, supermarkets and at roadsides are generally cheaper than imported fruits.





The arrival of Europeans has changed Islanders' perception of certain foods and food choices. It has also increased the varieties of food available. There are now more varieties of fruits to choose from. The demand for imported fruits such as apples, pears and oranges has increased compared with the demand for local fruits.

Some local fruits may not be as abundant as they used to be because they are not economically viable to grow. Some of the land has been taken up by local farmers to grow staples and cash crops for overseas markets. Additionally, good fruit-growing land has been taken up by urban sprawl in many Pacific Island towns and cities.

Since the 1960s there has been a decline in small-scale fruit production in many parts of the Pacific, particularly in Polynesia. This is due to the heavy migration of the work force to New Zealand and to Australia. In addition the labour force has shifted from an agricultural base to more industrially and commercially oriented services. There are also problems with transportation and marketing, as well as destruction of supplies by natural disasters — drought, floods and cyclones — all-too-frequent occurrences in the Pacific.

Recently, some Pacific Island governments have recognised the importance of promoting and maintaining indigenous fruit trees as economically viable commodities. Most Island countries now have policies and strategies for fruit and nut development. Agricultural research and extension departments in many islands are responsible for distribution of seeds or seedlings for planting. Schemes have been set up to encourage and promote fruit growing. Research projects on local varieties of fruits and those that would be viable in different areas are being carried out by local, regional and overseas organisations (Macfarlane, 1998).

As a result of the current policies and strategies, fruit production should contribute to Pacific Island economies in a significant way in the future. Tropical fruits have potential for development into cottage or export industries, which would create employment (Burdon, 1998).



## II. FRUITS FOR LIFE AND HEALTH —VARIETY, QUALITY AND TASTE

### **A store of goodness**

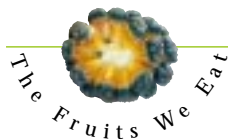
Pacific food guides classify fruits as health and protective foods (Dignan et al., 1994). They contain plenty of water and very little fat, and are excellent sources of Vitamin C and anti-oxidants (carotene or pro-Vitamin A), dietary fibre, and potassium (Dignan et al., 1994; Tunidau et al., 1990). Fruits contribute only an insignificant amount of energy to the Pacific Island diet.

Because fresh fruits provide a good supply of water, they are excellent thirst-quenchers, especially during hot weather. The higher the water content of the fruit, the lower the energy value (Tunidau et al., 1990). For example, watermelon and oranges are generally lower in energy value than fresh, ripe bananas. Fresh fruits make ideal snacks.

### **A quality substance**

The importance of ascorbic acid, commonly called Vitamin C, was known as far back as the eighteenth century, when it was recognised that citrus fruits prevented scurvy (Samson, 1986). Hence it was compulsory for British sailors to drink lime-juice during the times of the great European voyages of discovery. But the substance, Vitamin C, was finally isolated only in 1928 (Passmore & Eastwood, 1986).

Vitamin C keeps the body tissues strong and healthy. It is involved in maintaining connective tissues, synthesising neurotransmitters and hormones, maintaining the immune system, releasing stress hormones from the adrenal gland, absorbing iron, and providing anti-oxidant protection (Williams, 1993). Generally all fruits contain Vitamin C, some more so than others. Appendix 2, Figure 16, shows the Vitamin C content of some common fruits available in the Pacific. The average body needs approximately 30 mg per day and this can be easily provided by one or two serves of fresh fruits (Dignan et al., 1994). Vitamin C is water-soluble and can be lost through boiling, heating and cooking water (Savage et al., 1993; Williams, 1993).



Dietary surveys in Melanesia, for example in Vanuatu, have found that with increasing use of imported foods today (not necessarily just fruits), the consumption of fresh fruits and vegetables is gradually decreasing (Badcock et al., 1993). Other studies in Polynesia and in Micronesia show that fewer fresh fruits and vegetables are being eaten now than was the case years ago.

### **A healthy ‘top-up’**

Fresh fruits are excellent snacks for everyone. They provide a healthy ‘top-up’, especially for young children, who can get so absorbed in their daily activities that they forget to eat regular meals. Encouraging them to snack on fresh fruits is a good way of ensuring that they get extra energy, as well as a fair amount of water, vitamins, minerals and dietary fibre, in their diet. Fresh fruits, fruit salads and fresh vegetables are also low in fat, but still provide children with additional nutrients until the main meal.

Fruits must be washed properly and cleaned thoroughly to make them safe to eat (Tunidau et al., 1990). Serving children fruits daily is also a good way to teach children healthy eating habits right from the beginning (Fieldhouse, 1986). Arranging different shapes of fruits or using them to make a decorative face on a plate will make fruit servings more interesting to children.

### **Aroma and flavour**

In general, ripeness determines choice. Ripe fruit has a characteristic colour which is closely associated with the distinctive aroma and flavour of that particular fruit (Cavaletto, 1979). When green, the fruit is usually immature; it may not have any smell, or may smell and taste sour. When it matures and ripens, the colour of the fruit is transformed from green into yellow or orange, purple, red or brown, depending on the type of fruit. The ripening process develops the characteristic aroma (smell) and flavour (taste) of the fruit (Jen, 1989; Standal, 1979). For example, a ripe pineapple is usually golden-yellow and gives off a characteristic, delicious, sweet smell. This can contribute to a person’s decision on whether to select the fruit to eat or not.





Food scientists have found that the aroma or smell characteristic of any food is the combined result of many complex substances (Cavaletto, 1979; Jen, 1989; Standal, 1979). The flavour of fruits is a combination of the sweet or sour taste and the odour of the volatile compounds they contain. For example, the characteristic flavour of citrus fruits is due to volatile oils.

### **A sensible choice**

Consumer choice of fruit depends on acceptability. The acceptability of any fruit, tropical or otherwise, is dependent on cultural, psychological and sociological factors, and especially on the sensory characteristics of that food (Inglett & Charalambous, 1979). How does it look? How does it smell? How does it taste? Are its textural characteristics pleasing?

Acceptability is normally a result of learning experiences (Fieldhouse, 1986). For example, the taste for new fruits may be acquired by trying them and eating them many times. Different fruits may be culturally acceptable and eaten by one group or society, but not by others. Sharing may result in acceptance of each other's food. Some fruits have a distinctive taste that may be disliked by certain people but liked by others (Cavaletto, 1979). For example, soursop or ripe jack fruit can be delicious additions to the diet, but some people can be put off by their unfamiliar, strong flavour and taste. Trying out new food and familiarising ourselves with new tastes can change our attitude so that we accept the new food (Fieldhouse, 1986).

Today, acceptability can also be highly influenced by marketing. Local fruits such as mandarins and oranges are sold looking green on the outside, but perfectly ripe and ready to eat. Imported mandarins and oranges, on the other hand, are bright orange and look more appealing, yet may be tasteless.

Technology used in developed countries allows fruits to be picked unripe and then ripened in special chambers (Potter & Hotchkiss, 1998). This caters for large food companies' marketing priorities, such as yield per acre, travelling ability, storage capacity and shelf life, but not taste. Pacific Islanders have a different set of priorities.

Availability of fruit can be an important factor in the choice made by con-





sumers. Tropical fruits are generally seasonal. This means that different fruits are available at different times during the year (Berry, 1979; Stanton, 1986). Consumers' choice therefore may also be determined by what fruits are in season. The availability or non-availability of fruits will affect the final price the consumers may have to pay. Availability and price can be the deciding factor in the final choice. Sometimes imported fruits are cheaper than local ones.

Colour contributes significantly to the choice of fruit by Pacific Islanders (Cavaletto, 1979). Colour indicates ripeness, freshness, taste and coolness. The bright colour of fruits, such as the brilliant orange of certain pawpaws and mangoes, can attract consumers to buy them. Although some fruits may be cheaper and more nutritious, their unattractive colour may discourage people from choosing them. For example, the local varieties of oranges, which have a pale green to yellow-brown colour, may be cheaper, sweeter and more nutritious, but the more expensive imported oranges with a more attractive orange colour may be chosen instead. Colour is therefore an important factor in Islanders' choice of fruits for regular consumption.

The condition of fruits also affects consumer choice. If fruits are bruised, do not look fresh or are presented in an unattractive manner, consumers are not likely to be interested in choosing them (Cavaletto, 1979). Sometimes appearance can be deceiving. For example, ripe bananas are usually at their best when they have a few black spots on the skin. Knowledge about selecting the best-tasting fruits can only be learnt through experience

Size and shape influence the choice of certain fruits for ceremonial presentations. Fruits have to be a certain size and a certain shape before they can be culturally acceptable as gifts. For example, watermelons used for presentations or gifts to important people have to be large. In Papua New Guinea, pineapples or bunches of bananas used as a gift for a bride have to be big and be of a certain colour. Smaller ones are not culturally appropriate.

The knowledge of how to select the choicest of the bunch, learnt at village community level through observation and experience, is being lost to the Pacific Islands. Selection of imported fruits may require different criteria.



New skills will need to be learnt as more people become dependent on supermarkets and fresh-produce markets for fruit supply.

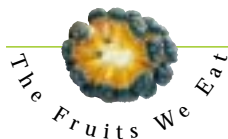
### **An enjoyable texture**

An important characteristic of fruits is texture. Texture is the sense of feel that contributes heavily to the quality of fruit (Cavaletto, 1979; Macfarlane, 1998). Each fruit has a distinctive textural property that influences consumer choice. When there is a plentiful variety of fruits to choose from, Islanders can be very particular in their preferences for fruit textures.

When we eat the fruit, it can feel smooth, soft, crispy, crunchy, juicy, firm or hard, stringy or fibrous (Cavaletto, 1979; Inglett & Charalambous, 1979; Macfarlane, 1998). Some people may prefer a firm, crisp, juicy fruit while others may prefer a smooth, softer variety. Generally fruits that have a fibrous texture are not as popular as the less fibrous ones. For example, mangoes that have a smooth texture are more popular than the fibrous varieties, while soursop is unpopular with some because of its unusual texture, often described as like 'cottonwool soaked in juice'. On the other hand, other fruits, such as pineapple, which is also fibrous, are much more acceptable.

The degree of ripeness of fruits provides a variety of tastes and textures. For example, half-ripe pawpaws are good for salads, snacks and cooked dishes; immature mangoes are widely used in Fiji for chutneys and pickles, and fresh mature ones are grated to make snacks or dessert.

Processing helps improve some of the undesirable taste sensations in some of these important, valuable fruits. The popularity of canned fruits is probably due to subtle changes in texture and sweetness resulting from processing and cooking. For example, mangoes become soft and smooth; pineapple becomes less fibrous and sweeter.



## Selecting the best

The degree of maturity and ripeness when picked and the method of harvesting determine quality. 'Maturity' is the condition of the fruit when it is ready to eat or, if picked, will become ready to eat on further ripening, while 'ripeness' is that optimum condition when colour, flavour, and texture have developed to a peak (Potter & Hotchkiss, 1998). The purposes to which the fruit will be put determine the selection criteria.

Many Pacific Island people prefer to eat fruits mature or half-ripe, while others may like them ripe. Whichever is preferred, harvesters must prevent damage to skin and bruising. Damaged fruits are soon infected by fungi and moulds, which cause rapid deterioration in our tropical climates.

Fruits that are allowed to mature properly and ripen on the tree are the most flavoursome. This is because the natural ripening process in fruit has taken its full course. This type of fruit is the best. However, it is not always possible to have fruits that have ripened on the tree, especially where the food-supply sources are a long way from populated areas. For these centres, fruits are best picked under-mature and transported to markets to be sold. The quality of these fruits may be badly affected during transportation. If fruits are picked ripe, they are often over-ripe and damaged by the time they reach their destination.

Below are general guidelines for the selection of fruits as a group (Savage et al., 1993; Tunidau et al., 1990):

When choosing fruits, look for those that are:

- in season,
- fresh,
- of good colour,
- whole and not bruised or damaged,
- clean, free from dirt and not eaten by insects,
- mature or ripe and firm, and
- have a fresh, sweet, fruity smell.



Storage is just as important as selection. Tropical fruits have a higher respiration rate than similar temperate-climate produce, because of warmer temperatures. Higher respiration causes quicker ripening and deterioration. Tropical fruits keep better in conditions of high relative humidity, because this slows down loss of moisture (Parkinson, 1989). Cooling also reduces respiration and increases storage life.

Fruits should be laid on shelves in a single layer, if possible, and covered with paper or thin cloth. Proper storage also depends on keeping fruits at the right temperature. Tropical fruits keep better in higher temperatures than temperate fruit. For example, the best temperature for storing most tropical fruits is 7–13°C, whereas temperate fruits are best stored at 0–2°C (Parkinson, 1989).





### III. USE OF TROPICAL FRUITS

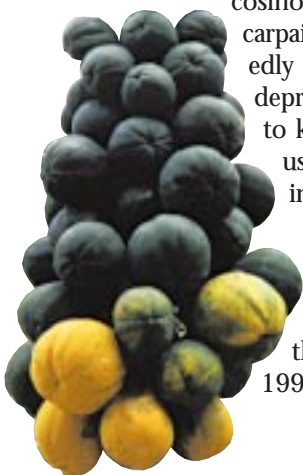
#### A major food source

In atolls such as the islands of Kiribati and Marshall Islands, the coconut is regarded as a staple and is one of the most important foods. It is a major source of energy and other essential nutrients. The flesh and juice of the green coconut provide a good quantity of Vitamin C as well as a number of important minerals and vitamins (Dignan et al., 1994). The energy-rich sap, known as toddy (*kareve* in Kiribati and *jekaro* in the Marshalls), is extracted from the coconut-flower bud. It is used as a drink while fresh, or boiled into a molasses-like concentrate (*kamaimai* in Kiribati and *jekmai* in the Marshalls) and then diluted as drink, or caramelised into a product similar to toffee (*kareberebe* in Kiribati and *jelinan* in the Marshalls) (Merlin et al., 1994). Fresh toddy can also be fermented (*te manging* in Kiribati) and used as a mild intoxicant and as a leavening agent. Fermented toddy is also used to marinate raw fish in place of lemon or lime juice.

#### Medicinal properties

Many tropical fruit trees have medicinal uses. For instance, several organic compounds present in pawpaw have health benefits (Inglett & Charalambous, 1979). Some of these have been identified as very significant and are useful in the pharmacological industry. These are benzyl glucosinolate, benzyl isothiocyanate, choline, carpaine, pseudo-carpaine and dehydrocarpaine I and II. Carpaine has been reportedly used as a relaxant to calm people and cheer those who are depressed (Inglett & Charalambous, 1979). It can also be used to kill germs. Pawpaw is also the source of papain, an enzyme used not only as a food tenderiser, especially for meat, but also in the cosmetic, leather and drug manufacturing industries.

The tips of the pandanus plant's roots are widely used in atolls for treating boils and sores (Hiyane, 1971). They also help to reduce fever, especially in children. In Fiji Islands, the root tip is used to treat fish poisoning (Cambie & Ash, 1994). The juice from crushed roots, fried with coconut cream,





was a common laxative, and the skin of the ripe fruit is used for urinary tract problems in the Cook Islands (Whistler, 1992). In Tonga, the tips of the root, mixed with turmeric and grated coconut, are applied to sores (Whistler, 1992).

The leaves of the guava tree are an effective cure for diarrhoea (Cambie & Ash, 1994).

The bark of the Polynesian plum tree (*Spondias dulcis*) is pounded, and prepared as a medicine (drink) for treatment of ciguatera fish poisoning in Vanuatu, especially in the Banks Islands and Emae (Walter, 1992). The leaves can also be used as a treatment for coughs.

In Kiribati, the mesocarp or white flesh of the coconut is used for treating infantile diarrhoea, and the male and female flowers of the coconut tree are used as a cure for gingivitis. According to Cambie & Ash (1994), coconut oil from the kernel is used for rubbing on stiff joints, and for treating rheumatic pains, limbs after severe strain, and pain in the back or stomach. Oil mixed with turmeric is supposed to have strengthening and therapeutic properties for sick new-born infants (Cambie & Ash, 1994). The juice of the red coconut, mixed with the bark of the *kavika* (Malay apple), *wi* (Polynesian plum), and pandanus root is used to treat fish poisoning (Cambie & Ash, 1994).

## Health benefits

The health benefits of fruits in the diet of Pacific Islanders cannot be underestimated (Landauer & Brazil, 1990; Samson, 1986). The role of dietary fibre and essential nutrients such as Vitamin C, the limited contribution to energy and the absence of cholesterol make fruits important components of the Pacific Island diet (English et al., 1996).

Eating fresh fruits is more beneficial than drinking orange juice or taking supplements such as vitamin pills. For example, the juice from five oranges does not provide five times the nutrients of one whole orange (Samson, 1986). The combined effects of nutrients and other substances in fruits (some of which are still unidentified) may help in the prevention of diseases and health problems. The numerous reactions and activities, such as anti-



oxidant effects and the presence of phyto-estrogens, may provide more clues for other unknown properties of fruits (Wahlqvist, 1997). We still do not know everything about the nature of fruits and their effects on the body. Nor do we know the long-term effects of taking vitamin supplements. These unsolved and unanswered mysteries tend to make one believe that the best advice is to keep to natural sources of nutrients, hence the saying 'an apple [or other fruit] a day keeps the doctor away'.

The physiological role of dietary fibre (as in the reduction of cholesterol levels in the blood, in cancer prevention and in the management of obesity and diabetes, among others) has put fruits back into the limelight (Savage et al., 1993; Williams, 1993; Passmore & Eastwood, 1986; Jardin, 1974). The presence of both beta-carotene and dietary fibre make fruits important preventive health components in the diet. Epidemiological studies have also found that higher intakes of carotene (fruits are a good source), may reduce the risks of some cancers (Wahlqvist, 1997).

Traditionally, the variety and amount of fruits consumed provided protection against certain types of health problems. With the apparent gradual decrease in the consumption of fresh fruits and vegetables, Islanders are now more prone to a host of health problems, some of which might be prevented if a wider variety of fresh fruits were part of the regular diets. Promotion of the beneficial effects of fresh fruits as a regular component of the Pacific Island diet must therefore be a priority for all nutrition education programmes.





## Food preparation and processing

Traditionally fruits are mainly eaten raw. They should be washed thoroughly before they are eaten. This ensures that soil, micro-organisms, and traces of sprays are removed. It is also a good idea to remove the outer skin from the stem, and the blossom ends, because they are hard to clean (Charley, 1982).

Some fruits are used to make puddings for special occasions and when there is an over-abundant supply. In the Cook Islands, the traditional preparation and preservation of certain fruits such as bananas are still carried out, but only on a small scale.

When fruits are in season and there is a surplus, they can be preserved in sugar and acid (vinegar, lime juice). Although they lose some vitamins, they add flavour to meals and can last for one or two years if preserved properly. Green pawpaw (papaya) or lime made into pickles are examples of this type of preservation. Some fruits, such as pineapple, mangoes, pawpaw and ripe bananas, can be made into chutneys by boiling them with vinegar, sugar and spices.

Modern methods of preservation include canning and bottling of fruit, vacuum-sealing and use of refrigerators and freezers (Rare Fruit Council, 1981). Small-scale processing of fruits into jams, preserves and glaze is being developed. Certain fruits, when in season, can be dried using solar energy or after being treated with chemicals such as sulphur dioxide. Bananas, mangoes, pawpaws and pineapples can be dried successfully. Mango and citrus skins can also be made into sweets and candied peels.

Fruits are also used for the production of juice. Citrus fruits, as well as their leaves, are used to make delicious and refreshing drinks. Recipes for these are widely available (South Pacific Commission, 1995).

Fruit production for export is a commercial activity that some Island governments in the Pacific are developing. Fruits are exported either fresh or made into juice (Carlos & Ooi, 1987). Despite a decline in fruit production in the last 20 years in the Pacific, fruit juice is still produced in Fiji Islands, New Caledonia and other islands, mainly for local consumption.





Certain fruits are very useful in food preparation because of their special properties. For example, papain, an enzyme from pawpaw, is used to tenderise meat (Berry, 1979), and citric acid from the juice of citrus fruits such as lemons and oranges is used for preserving fruits and vegetables. Acid from citrus juice is used in food processing and basic cooking (Potter & Hotchkiss, 1998).

Cooking changes fruit in a number of ways. It loses its crispness and becomes limp due to loss of water from the plant cells; it becomes more translucent (Charley, 1982). The fruit becomes tender as its structure is broken down by heat.

Dried fruit becomes harder, however, due to the removal of water during the drying process. Dried fruit may be softened by soaking in water to hydrate it for use in recipes (Charley, 1982).





## Pacific delights

In both Melanesian and Polynesian countries, such as Papua New Guinea, Tonga and Fiji Islands, local drinks using citrus leaves are prepared by infusing the leaves with hot water. The leaves of the lemon tree are picked and placed in a teapot or large container or pot, and boiling hot water added. The lid is closed for two to three minutes. When ready, the drink is poured into cups and served as a substitute for tea (Peace Corps, 1977).

In Mokan (Marshall Islands), a delicious traditional cake is made from pandanus paste. The paste is extracted by grating the pulp from cooked or raw pandanus fingers (phalanges). The phalanges are boiled, or baked in the ground oven or *um* (Marshalls). Arrowroot flour or sugar can be added to the grated pulp. The mixture is then dried in the sun to form a dry paste. The paste is further dried over hot stones until a thick, firm cake is produced. The cake is then stored, wrapped in pandanus leaves and secured with a coconut leaf frond. Traditionally, this valuable food was prepared and stored for use during long sea voyages (Baiteke, 1990; Hiyane, 1971)



An excellent pandanus dish for babies or older people who cannot chew can be made from the juice of boiled or baked phalanges. The juice is extracted and then mixed with grated coconut and served.

Samoa *supo esi* can be made as a porridge or a dessert. To prepare this delicious dish you need half a cup of coconut cream, one tablespoon sugar, one cup cassava starch, four cups grated ripe pawpaw, and one cup water. Put coconut cream, water, sugar and grated pawpaw into a pot and boil slowly for 10 minutes. Sprinkle with dried starch, a little at a time, stirring constantly to avoid lumps. Serve hot as a porridge or cold as a dessert. For variety, you can also use mashed pumpkin or mashed ripe bananas (SPC, 1995).

The publication *Palauan Foods: Naturally the Best* (Malolo et al., 1995) contains a star fruit drink recipe to help quench your thirst: remove edges of star fruit. Wash, cut into small pieces, place in a clean bowl and mash



finely (use electric blender if available). Strain into a clean jug, then add sugar, water and juice of one lemon to taste. Serve cold.

To prepare a soursop drink, mix three quarters of a cup of soursop pulp with one quarter of a cup of water. Add sugar to taste. This is a cool, refreshing drink and best served on a hot day (Malolo et al., 1995).



### III. SOME COMMON FRUITS EATEN IN THE PACIFIC

Twenty-seven commonly eaten fruits are described in this section. They are presented in two groups: **major fruits** and **minor fruits**. Some of these fruits are also classified as staples, e.g. green bananas, pandanus.

The section briefly describes individual fruits, and gives their scientific name, origin, cultivars, climatic and growing conditions, social and economic uses (where applicable), and nutritional value. The chemical composition (nutrient content) of these fruits is presented graphically in Appendix 2.

The information given on fruit availability and seasons applies to islands south of the equator. North of the equator, seasons are reversed.



#### A. MAJOR FRUITS

This handbook considers avocado, banana, citrus, coconut, mango, pandanus, pawpaw (papaya) and pineapple to be major tropical fruits because they are widely used in the Pacific Islands and provide significant amounts of nutrients in the diet.

##### 1. Avocado: *Persea americana*

The avocado has been growing on Pacific Islands for many years. It was first cultivated in Central South America approximately 7000 years ago and spread to Jamaica, then to the United States and probably to the Pacific in the nineteenth century (Samson, 1986). The three common varieties are the Mexican, Guatemalan and West Indian. These can be differentiated by their skin. The Guatemalan type has a light-green skin which is thicker than that of the Mexican, while the West Indian variety has a thick pebbly skin (Darley, 1993). The most common varieties available now are either Guatemalan or hybrids between Guatemalan and Mexican, or West Indian (Darley, 1993).





A number of local varieties were the subject of trials in the Pacific in the 1980s as a potential export fruit. Results of the trials are not known. However, a very limited number of avocados were exported in 1984. Barriers to maintaining production appear to be problems with fruit fly and increased competition with overseas markets (Christantly, 1990). In addition, the plant can develop *Phytophthora cinnamoni*, a very common disease which causes seedling blight, stem canker and root rot (Badcock, 1983; Samson, 1986).

The majority of trees grown in the Pacific are from seedlings raised from mature fruit seeds; germination normally takes four weeks (Stanton, 1986).

### *Selection*

Maturity is judged by a well-rounded appearance. Avocados mature but do not ripen on the tree (Darley, 1993). Mature fruit may fall on the ground, but this can cause bruising. They are best picked and then ripened. Ripening can occur within a week after harvest. Fruits prematurely harvested are inferior in quality (Darley, 1993). Avocados are ripe when the green-skinned fruits turn greenish yellow or purplish maroon and become soft (Samson, 1986). Test by gently pressing fruit with the fingers.

When selecting avocado, it is best to choose those that are firm, have no bruising and have unbroken skin. The degree of firmness will depend on how soon the fruit is needed. The main fruiting season in the Pacific Islands is generally from January to May, but may vary slightly from country to country (Parkinson, 1989).

The quality of avocados is normally assessed by the amount of fat they contain at maturity. Better varieties contain no less than 20 per cent fat (Darley, 1993; Samson, 1986).

### *Storage*

Mature avocados will ripen in a week or less when stored under normal temperatures. The ripening process may be slowed down by keeping the fruits at lower temperatures. Mature fruit refrigerate well, wrapped in layers of newspaper to prevent dehydration. The fruit can then be taken out and ripened at room temperature when needed (Darley, 1993).



Avocados do not keep well once ripe, but may be kept in a good condition in a cool room at 7–12°C (Parkinson, 1989). The quality will deteriorate if kept at a lower temperature. For longer storage, whole fruits can be frozen or pureed with a little lemon juice to prevent discoloration.

### *Preparation*

Avocado flesh oxidises and turns an unattractive and unappetising brown colour when exposed to the air. The most practical way to slow or reduce this change is to sprinkle lemon juice on it. In addition, the prepared fruit should be kept as cool as possible. Once cut, avocado should be used as soon as possible.

To serve avocado in the shell, cut fruit in half without cutting the seed, open, remove the seed by flicking it sideways with the tip of the knife, scrape off any brownish layer under the seed, cut the flesh with the tip of a knife if necessary, and sprinkle with lemon juice.

Sliced or cubed avocado can be made by halving the fruit, removing the seed, peeling off the outside skin (this comes off easily when avocado is ripe), cutting into wedges or slices and using as desired. Alternatively, cut the fruit in half, remove the seed, and scoop out the flesh with a spoon. Puree is made by blending or mashing and sieving the flesh of the avocado.

### *Food value*

Avocado is an unusual fruit because it contains fat. Its fat has no cholesterol and has mono unsaturated and polyunsaturated fatty acid forms (Dignan et al., 1994; Darley, 1993). It has approximately 20–23 per cent fat and some protein, and is a good source of vitamins, particularly the E and B complex groups, and some minerals. Because of its fat content, avocado contains more energy than other fruits. Half an average avocado has about 820 kJ or 196 kcal (Stanton, 1986).

### *Use*

Avocado is best used raw. If used in hot dishes, it should not be allowed to boil, as this changes the flavour. Avocado can be cut into cubes and used as an ingredient in fruit and vegetable salads. Puree avocado and season it with



salt, lemon juice and pepper to use as a base for soups, dips and savoury dishes. Plain puree can be used to make ice cream and milk shakes. Flavours that go well with avocado include citrus, onion, garlic, parsley, tomato, capicum, tuna, soursop, honey and sugar (Parkinson, 1989). In Latin America, avocados are served to each guest, to be spooned from the shell into soups or stews (Rare Fruit Council, 1981).





## Avocado Soup *(serves 4)*

### You will need

- 1 cup avocado puree
- 1 dessertspoon lemon juice
- 1 clove garlic
- 3/4-teaspoon salt
- 1/8 teaspoon chilli sauce
- 2 cups chicken stock
- 2 cups milk  
or thin coconut cream

### Method

1. Prepare avocado puree and sieve. Mix well with lemon juice, crushed garlic, salt and chilli sauce.
2. Stir in stock and milk or coconut cream.
3. Test for seasoning.
4. Chill and serve very cold.
5. Serve garnished with parsley







## Baked Avocado and Fish *(serves 4)*

### You will need

- 2 large avocados
- Lemon juice
- 2 tablespoons butter
- 2 tablespoons flour
- 3/4 cup milk or thin coconut cream
- 1/4 teaspoon salt
- 1/4 cup chopped onion
- 1/4 teaspoon thyme
- Pepper
- 3/4 cup fish – canned or leftover
- 1 hard-boiled egg, chopped (*optional*)
- 4 tablespoons mayonnaise

### Method

1. Cut avocados in half lengthwise, remove pits, rub inside with lemon juice and set aside.
2. Melt butter, blend in flour and gradually add milk (or substitute), stirring continually over low heat until sauce is smooth.
3. Add seasonings, fish, eggs and onion and stir until well blended.
4. Heap mixture into centre of avocado halves and bake in 180°C oven for 15 minutes.
5. Remove from oven and top each with 1 tablespoon mayonnaise.
6. Return to oven and bake 15 minutes longer.
7. Serve hot.





## **2. Banana: *Musa acuminata* and plantain: *Musa paradisiaca***

This handbook discusses the two types of banana together because of their many similarities.

Bananas are probably one of the oldest cultivated and amongst the first food plants of man. In the Pacific, with the exception of some atolls, they are the most widely grown fruit (Lambert, 1968).

The true indigenous bananas were found mostly in the Western Pacific. Bananas belong to the genus *Musa*. The plantain is *Musa paradisiaca* and the sweet banana eaten raw is *Musa acuminata*.

The species probably originated from Indonesia and Malaysia (Darley, 1993). The two general types of bananas grown and used in the Pacific are the cooking banana (plantain) and the common eating bananas, which are best eaten raw when ripe. The common eating bananas are the Cavendish, which has larger fruits, and the small, sweet type called lady's fingers (Parkinson, 1989).





Bananas grow in different types of soil, but the most suitable are loose and well drained. About one year after planting, banana plants bear fruit. Each plant flowers and fruits only once. However, new suckers continue the life of the corm (Darley, 1993).

New plants are normally produced by planting the suckers (Lambert, 1968). A sucker unrolls a fixed number of leaves before fruiting occurs (Darley, 1993). Bananas may fruit at any time during the year, but most commonly in the warm months. The size of the bunch (number and size of the hands, size of the bananas) largely reflects the health and conditions of the sucker (Darley, 1993). Banana was one of the major cash crops exported to New Zealand in the early 1970s and 1980s by some Pacific Island countries.

### *Selection*

Bananas that are fully mature and/or beginning to ripen on the plant have the best flavour. However, fruit left to ripen on the plant attract birds. In addition, if we live in urban areas and have to depend on the market for our supply, most of the ripe bananas we buy are harvested green, and may not be fully mature before harvest. As bananas ripen, starch is converted to sugar, the fruit softens and the colour changes from yellow-green to yellow, then to gold, eventually becoming mottled with dark spots (Darley, 1993).

When selecting bananas, choose those that have a more rounded appearance, with few or no ridges, because they will be fuller. Fruits must be free from bruising and sap stains. It is best to select those that are just beginning to turn yellow, because they will ripen in the next few days. Bananas ripen very quickly in our climate, so ripe bananas will not last. The best temperature for the ripening process is 18–22°C. Fully ripe bananas with dark spots are the best for young children because all the starch in the fruit has been converted to sugar.





### *Storage*

Whole bunches may be obtained and are best hung in a cool store-house or cool part of the kitchen. However, bananas are more commonly sold in hands. Ripe bananas bruise easily, so care must be taken when transporting them. The mature bunch can be left on the plant and only the most developed hands (beginning to turn yellow) harvested as necessary. But this is advisable only if the plant is close to home.

Mature or half-ripe bananas, in either bunches or hands, can be ripened under controlled conditions. Ripening can be accelerated by placing the fruits in a warm place or in a plastic bag. They deteriorate when stored below 12°C. Fruits are best stored at a cooler temperature of 13–16°C (Potter & Hotchkiss, 1998). Ripe bananas may be refrigerated, but the cold temperature turns the skin an unattractive, dark-brown colour. The fruit eventually gets bruised and soft.

For international trade, bananas are stored at 14°C to stop ripening and to allow long-distance shipping. To ripen them, the temperature is increased and fruit is exposed to ethylene gas which allows the fruit to be stored for a month at 30°C (Darley, 1993).

### *Preparation*

All three types (plantain, Cavendish, lady's fingers) have similar characteristics. Recipes for one can be used for the others.

Ripe fruit should be washed well before use. Peel and trim off ends before eating. It is best to prepare bananas just before serving, to prevent them from being exposed to air and becoming oxidised. To mash bananas, use a fork and mash on a flat plate. For use in recipes, sliced or mashed bananas should be dipped in lemon juice to prevent browning. For some plantain recipes, it may be necessary to cut the fruit in half lengthwise and remove the dark middle vein.

Green bananas can be cooked in their skin as well as peeled. When cooking in the skin, wash and trim the ends before boiling or baking. When cooked, peel off the skin — it should come off easily. Bananas that are just beginning to turn yellow have a sweet tangy taste when cooked. Some recipes may require peeled green banana. In this instance, peel with a knife or a



sharp shell and place the peeled banana in water immediately to prevent browning before use. Green bananas stain badly and the stains are almost impossible to remove, so care must be taken not to get banana sap on clothes.

### *Food value*

Ripe bananas are easily digested. They are a good source of energy — an average-sized banana contains about 377 kJ or 90 kcal (Stanton, 1986). They are high in potassium (approximately 400 mg/100 g), and also contain some fibre and Vitamin C (Dignan et al., 1994). Plantain can be a good source of carotene in the atolls.

### *Use*

Bananas are eaten fresh as a fruit or used as an ingredient when ripe and as a starchy staple when green.

As a fruit, all three types are best eaten raw. Ripe bananas provide an excellent snack, fresh or dried. Sliced bananas can be added to fruit salads. Pureed banana can be used to make ice-cream, cake, loaf, scone, pancake, muffin, soufflé and mousse. Ripe bananas can also form the base for side dishes to serve with curry when mixed with grated fresh coconut, sultanas and lemon juice.

Although ripe plantain is also eaten raw as fruit, it is more commonly used cooked.

All three types are made into delicious traditional puddings by mixing with cassava flour and coconut cream (e.g. *poke*, a Cook Island dish; *lote*, a Fijian dessert). In parts of Fiji Islands, ripe plantain is used in place of green leafy vegetables to cook with fish in coconut cream.

Fresh ripe bananas make an excellent weaning food for young children. Mashed with some breast milk, or mashed and cooked in thin coconut milk, bananas provide a valuable supplement to the infant's diet.

Half-ripe banana makes a very tasty snack when boiled or fried as chips.



## Bananas with Orange and Cardamom *(serves 5)*

### You will need

- 10 medium-ripe bananas (Cavendish)
- 4 tablespoons butter
- 1/4 teaspoon cardamom seeds
- 1/2 cup orange juice
- 2 tablespoons lemon juice
- 4 tablespoons sugar

### Method

1. Peel bananas and cut in half.  
Allow 4 halves per person.
2. Heat butter and sauté banana until golden brown; place in a serving dish.
3. Add the cardamom seeds to the butter and sauté for one minute.
4. Stir in the brown sugar, lemon and orange juice. Simmer until sauce begins to thicken.
5. Pour over bananas and serve very hot with cream.



## Plantain Roll *(serves 4)*



### You will need

- 4 small ripe plantains
- 1<sup>1/2</sup> cups freshly grated coconut
- 4 cups grated cassava
- 4 tablespoons powdered milk *(optional)*
- 4 dessertspoons sugar
- Banana leaves, softened, for wrapping

### Method

1. Mix grated cassava, 1 cup coconut, sugar and milk powder well.
2. Select well-ripened plantain. Peel, slice the fruit in half lengthwise, remove the dark mid-vein and the flesh surrounding it to make a shallow well the size of a small finger along the length.
3. Stuff one half with freshly grated coconut, and put the other half on top of the stuffed side. Mould one cup of grated cassava mixture around the stuffed plantain.
4. Wrap with banana leaves and tie ends.
5. Bake at 180°C for about 1 hour or place the parcels in a pot of boiling water and steam.



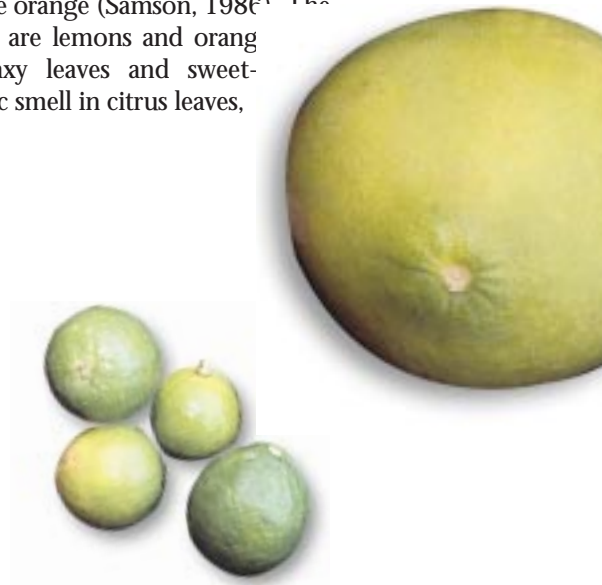


### 3. Citrus fruit: Rutaceae

Citrus fruits belong to the large family Rutaceae, which contains more than 100 species. Their classification is very difficult because of the large number of hybrids (Samson, 1986).

The cultivation of citrus dates back to 2200 BC in China, but other records indicate that it must have spread throughout Southeast Asia well before that (Stanton, 1986). Travellers, missionaries and explorers greatly assisted the spread of citrus in the Pacific, especially when the fresh fruits were found to be the best remedy for scurvy. In some parts of the world, for example in the British Navy, it was compulsory for sailors to drink lime juice every day.

Generally citrus fruits are divided into two categories: *Papeda* and *Eucitrus*. The fruits in the *Papeda* category are inedible, while the *Eucitrus* contains ten edible species, eight of which are cultivated. *Eucitrus* includes sweet oranges, sour oranges, mandarins, grapefruit, shaddock or pomelo, lemon, citron, lime, kumquat and trifoliate orange (Samson, 1986). The most common sub-tropical fruits are lemons and oranges. The trees have dark-green, waxy leaves and sweet-smelling flowers. The characteristic smell in citrus leaves,







flowers and fruits is caused by essential oils containing several flavonoids, the most common being hesperidin (Samson, 1986). Other more specific flavonoids may be present in some fruits, such as mandarins. The characteristic colour of citrus fruits is due to carotenoids — the yellow, orange and red pigments. Some of these pigments do not develop in tropical areas, especially in the Pacific, because the temperature does not fall below 13°C (Darley, 1993). This explains why some tropical oranges and mandarins remain green even when fully mature.

In some Pacific Islands, citrus is grown as garden or small backyard fruit trees for the family and for local sale, or in the bush. Attempts have been made to grow citrus trees (mainly limes and lemons) in the atolls, as a source of Vitamin C. According to reviews of fruit and nut trees in five Pacific Island countries (Carlos & Ooi, 1987; Watson, 1997), their potential to thrive has been variable due to lack of organic matter and iron in the soil. Even easy-to-grow varieties such as the lime (*Citrus aurantifolia*) have not grown very well.

Citrus has been a major commercial crop in a number of Pacific Island countries, especially the Cook Islands and Fiji (Carlos & Ooi, 1987). In the Cook Islands production increased steadily from 1966 until 1976, when it began to decline. Some reasons for reduction in output were the lack of replanting materials (trees) to maintain production, limited technical expertise in developing new varieties (from tall trees to dwarf plants), the poor shipping service and lack of identified overseas markets.

In Fiji Islands, citrus production was initiated in 1977 with the aim of producing oranges for processing into fruit juice. Production has increased steadily since 1984; however, due to marketing problems (Carlos & Ooi, 1987), the oranges and orange produce have had to be confined to the local market.

In Tonga, production of citrus is very much a subsistence activity, with very irregular exports of a few varieties such as limes in the 1980s. Even production for the local markets has often been hindered by the presence of diseases such as *Tristeza* wilt and *Phytophthora* collar rot (Carlos & Ooi, 1987).



In atolls such as Kiribati a range of citrus trees, including Eureka and Lisbon lemons, was introduced in the early 1980s (Baiteke, 1990). Propagation of planting materials was from seeds because of the likelihood of certain pests and diseases developing in young trees or cuttings. A variety of budded plants of oranges, lemons, limes and mandarins are distributed and sold at government nurseries for household food gardens in Kiribati.

A recent assessment of the potential for fruit trees for planting in the atolls concluded that successful culture depends on the management, choice of varieties and rootstock. Some successful work carried out in Tuvalu and Kiribati has identified rough lemon (*Citrus jambhiri*), Rangpur lime (*C. x limonia*), and *Volkameriana* lemon rootstocks as the most suitable (Watson, 1997).

There are hundreds of cultivars or varieties available now. These have been made possible by vegetative propagation (Samson, 1986). Citrus can tolerate a wide range of climatic conditions. They grow well in a variety of soils, from coarse sand to heavy clay soils. Good drainage is essential for sustained high yields. Limes seem to grow best under very tropical conditions, while oranges and lemons grow well under cooler conditions. Some characteristics of citrus fruits grown in the Pacific are summarised in Table 1.





**Table 1: Some citrus used in the Pacific Island**

Citrus fruit	Scientific name	Local names (fill in)	Food value	Description	Preparation, cooking and use
Sweet orange	<i>Citrus sinensis</i>		Good source of Vitamin C and dietary fibre.	Round and smooth; green yellowish to orange.	Best eaten fresh. Can be made into jam. Use in salads, drinks. Oils from peel are used in production of perfume.
Mandarin	<i>Citrus reticulata</i>		Good source of Vitamin C, carotene and dietary fibre.	Flattened round shape, slightly smaller than an orange; green or yellow-orange.	Eaten fresh, used in jam making and preserves, garnishes and drinks.
Grapefruit	<i>Citrus paradisi</i>		Good source of Vitamin C and dietary fibre.	King-sized fruit shaped like an orange; light green to yellowish.	Best eaten fresh, made into jam, marmalade and fruit juice.
Pomelo	<i>Citrus grandis</i>		Good source of Vitamin C and dietary fibre.	Large, round, slightly pear-shaped, with thick pink, yellow or white skin. Flesh tastes sweet/sour.	Eaten fresh or made into drinks, jams or candied fruits.
Kumquat	<i>Fortunella japonica</i>		Very good source of Vitamin C, and some dietary fibre.	Small; round or elongated, with spicy, bright orange skin.	Whole fruit can be eaten, or used in drinks, jam-making, preserves or as garnishes for other dishes.
Lemon	<i>Citrus lemon</i>		Very good source of Vitamin C and dietary fibre.	Round; pale green to yellow; rough skin; similar in size to an orange.	Drinks, marinating fish, add to other marinades, flavourings and garnishes. The leaves are used in place of tea leaves for hot drinks.
Lime	<i>Citrus aurantifolia</i>		Very good source of Vitamin C.	Round; thin, smooth skin; pale green; some are seedless.	Used in drinks, flavour enhancers, jam-making, desserts.



### *Selection*

When selecting citrus fruits, look for those that are firm, wholesome, properly ripe, have the fresh smell characteristic of the type of citrus, are not bruised or damaged, are of good colour, and feel juicy.

Citrus fruits may be eaten fresh (oranges, mandarins, and grapefruit) or used for drinks. Lemons and limes are used for drinks, or as a marinade for fish in places where a lot of fish is consumed on a daily basis. Segments of oranges and mandarins can be used in fruit salads or vegetable salads. They are also canned (Samson, 1986). In overseas countries, pectin and essential oils are commercially extracted and processed from the peel of citrus fruits. Citric acid is commercially processed from lemon and lime.

Oranges and mandarins consists of about 8–10 per cent sugars, 30–47 mg of Vitamin C per 100 g, 89 per cent water, approximately 1 per cent citric acid, traces of minerals and other vitamins. One orange or mandarin or a glass of fresh juice is therefore sufficient to provide the daily Vitamin C requirement (30 mg per day) for an adult. The less sweet the fruit, the more citric acid it contains. For example, lemon and lime contain 6–8 per cent and grapefruit about 1.5 per cent (Samson, 1986).





## **Grapefruit: *Citrus paradisi***

It is not known when grapefruit were introduced into the Pacific, but they are widely grown in most parts of Polynesia and Melanesia and in some atolls. Grapefruit have been promoted as having potential benefits in the tourist market (used in local hotels), as well as for export.

### *Selection*

Select fruits of similar size and pale yellow-green (or pinkish-yellow in some varieties) colour. Small to medium sizes are usually juicier. The skin should be clean and free from blemishes.

### *Storage*

Grapefruit are best stored in a cool place. In cooler months, fruits will keep for two weeks. The flavour and juiciness improve with storage. Grapefruit juice can be frozen for longer periods.

### *Preparation*

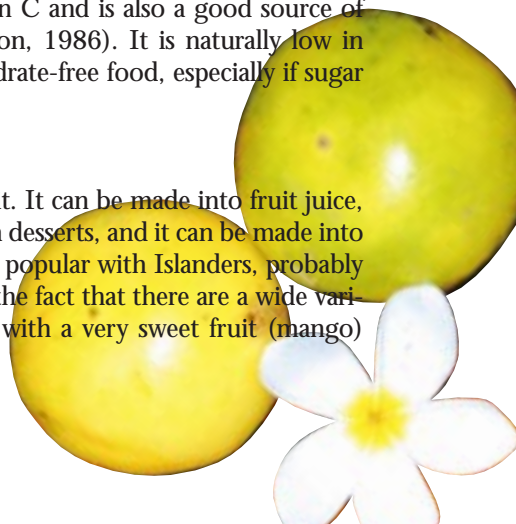
To prepare grapefruit for breakfast, wash fruit well, cut in half crosswise, loosen the segments with a sharp knife so that they can be lifted out with a spoon, if necessary sprinkle sugar on the fruit, and cool in the refrigerator overnight. The segments can also be lifted out and served on a plate with honey.

### *Food value*

The fruit is an excellent source of Vitamin C and is also a good source of dietary fibre (Dignan et al., 1994; Stanton, 1986). It is naturally low in sugar and can be considered as a carbohydrate-free food, especially if sugar is not added to it when eaten.

### *Use*

Grapefruit makes a delicious breakfast fruit. It can be made into fruit juice, segments can be added to salads or used in desserts, and it can be made into marmalade. Unfortunately the fruit is not popular with Islanders, probably because of its bitter acidic taste as well as the fact that there are a wide variety of alternative fruits available. Mixing with a very sweet fruit (mango) can overcome its sourness.





## Chicken and Grapefruit Salad *(serves 4)*

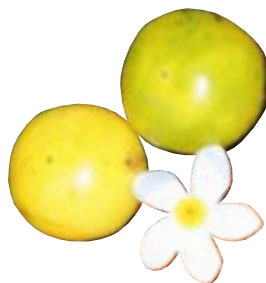


### **What is needed:**

- Half a cold cooked chicken
- 1 large or 2 small grapefruit
- 2 large oranges
- 1 cup non-fat yoghurt
- Squeeze of lemon juice
- Freshly ground black pepper
- Lettuce

### **Method**

1. Remove skin and bones and cut the chicken meat into small pieces.
2. Peel the grapefruit and oranges, divide into segments. Remove any seeds and the membrane separating each segment.
3. Combine oranges, grapefruit and chicken with yoghurt, lemon juice and pepper.
4. Put in a bowl, cover and chill for at least an hour.
5. Serve in lettuce-leaf cups.





### **Kumquat:** *Fortunella japonica*

Kumquat (or cumquat) is the smallest of the citrus family. The tree was initially cultivated in China. From there it spread to Malaysia, Japan and Australia and into the Pacific (Stanton, 1986).



However, in the Pacific the kumquat that is widely known is the calamondin orange (*Citrus mitis*), which can also grow in atolls. This is a small version of an orange and slightly rounder than the true kumquat. The immature fruits are green in colour, but gradually turn yellowish-orange when ripe. They are easily grown in backyard gardens or can be grown around the villages in the islands. They seem to fruit earlier and more abundantly than the other citrus

trees. They also fruit almost all the year round. It is the only citrus fruit which can be eaten skin and all (Rare Fruit Council, 1981)

#### *Selection*

Choose firm, greenish-yellow fruits. They must be whole and not have torn skin around the stem end. Select the largest fruits if possible.

#### *Storage*

Kumquats have a very short life. If stored in a cool place, the fruits will last up to three days. If refrigerated, the fruits will keep for longer. For longer storage, squeeze the juice and freeze in cubes. Frozen kumquat cubes can be taken out and used as required.

#### *Preparation*

Extracting kumquat juice is time-consuming, because of the small size of the fruit, and probably best done by hand.

#### *Food value*

The Pacific kumquat or calamondin is an excellent source of Vitamin C and Vitamin A. It also has a fair amount of dietary fibre and small quantities of minerals and vitamins (Dignan et al., 1994; Kirschmann, 1996).



### *Use*

Because kumquat juice is rich in pectin, it is ideal for making jam or preserves. Kumquat juice has a different flavour and makes a delicious drink. It can be used instead of lemon or lime as a marinade for raw fish. It can also be used as garnishes in salads and main dishes. Kumquat skin and/or rind make an excellent flavouring for both sweet and savoury dishes because it is not bitter like other citrus fruits.







## Kumquat Custard *(serves 4)*

### You will need

- 1/2 cup kumquat juice
- 1 cup water
- 2 tablespoons kumquat peel
- 2 tablespoons flour or cornflour
- 3 egg yolks

### Method

1. Combine juice, water, sugar and finely sliced kumquat peel in a pot.
2. Bring to the boil and stir till sugar dissolves. Take out 1/4 cup and cool.
3. Make a paste with the flour and the 1/4 cup cooled syrup mixture.
4. Add paste to the syrup and bring to the boil, stirring all the time. Remove from heat.
5. Beat egg yolks in a large bowl and stir in a little hot syrup mixture. Continue to add the rest of the syrup mixture to the beaten egg yolk, stirring all the time.
6. Pour the mixture back into pot and cook over slow heat till yolks have thickened. Do not boil.
7. Serve as sauce on fruits, chill and top with ice cream, or use as filling for pie.





## Kumquat Jelly

### Method



### You will need

- 1 kg kumquat fruit
- Sugar

1. Wash fruit, cut in half and place in a large pot.
2. Add enough water to just cover the fruit. Bring to the boil, lower the heat and simmer until the fruit is soft. Cool (this can be done overnight).
3. Strain the juice through a cloth; making sure not to squeeze or force it out.
4. Measure the juice into another clean large pot and add  $\frac{3}{4}$  – 1 cup sugar for every cup of juice.
5. Bring the mixture to the boil, stirring until sugar has dissolved. Boil rapidly until it passes a gel test.\*
6. Bottle in hot, sterilised jars.

*\* Gel test: put a small amount of the mixture on a cold plate; leave for a minute. If it wrinkles when pushed gently with a finger, it is ready to be bottled. If it is still watery, it is not ready yet.*





### **Lemon:** *Citrus limon*

Lemon trees grow easily on Pacific Islands. The lemon tree is said to have originated in India, Burma and the southern part of China (Stanton, 1986). There are two main types of lemon found in the Pacific: the rough or bush lemon (*C. jambhiri*), which has very thick skin with a rough surface, and the lemon (*C. limon*) which has a smoother skin and is juicier (Darley, 1993). Lemon fruit is normally round, with either a smooth or rough green to yellowish skin. Lemons can be planted from the seeds of ripe fruits. They sometimes flower and fruit all the year round. There are also seasonal varieties.



#### *Selection*

There may be more than one variety of lemon available, but choose freshly picked, firm fruits with yellowish, clean skin and a good regular shape. Fruit sizes may be variable, but those with thin skins are juicier. The rough-skinned or bush type with thick pith is considered by many to have a superior flavour. It has a richer aroma, especially in the grated skin.

#### *Storage*

Firm, mature fruits will keep at a cool room temperature for one to two weeks. If stored covered in the refrigerator, they will keep for up to three to four weeks. For longer storage, squeeze out the juice and freeze.

#### *Preparation*

To prepare juice, cut fruit in half, and extract the juice from each half by inserting a fork and twisting, or squeezing by hand, or using a lemon squeezer. The rind can be obtained by carefully grating off the coloured part of the skin, taking care not to include the white part, which is bitter. Cut thin slices for cooking and for garnishes. Serve wedges with fish.

#### *Food value*

Like the other citrus fruits, lemons are excellent sources of Vitamin C, and contain small amounts of minerals and vitamins (Dignan et al., 1994). They are also a good source of soluble fibre (Stanton, 1986).



### *Use*

Lemons can be used interchangeably with kumquats and limes, depending on availability and consumer preferences. They are used in many ways to improve food flavour and texture.

The juice is used for making drinks and desserts, and in cake recipes. One major use is as a marinade for fish. Lemons are used with other ingredients for marinating and flavouring meat and chicken, and for preparation of dressings for vegetables. Lemons contain pectin, which is required for jelling of jam, especially with fruits containing little or no pectin. The skin or peel can be used in the processing of marmalade, and also as flavouring for cakes and desserts (Stanton, 1986). Lemon can also be used to make pickles.





## Lemon/ Lime Pork or Chicken Casserole *(serves 4)*

### You will need

- 500 g pork or chicken pieces
- 60 g lemon/lime
- 1 tablespoon cornflour
- 1/2 cup water
- 1 tablespoon soy sauce
- 1 teaspoon sugar
- 1/4–1/2 teaspoon salt
- 1 small piece of ginger

### Method

1. Arrange meat pieces in a shallow casserole dish.
2. Cut lemon/lime into thin slices and place on top of chicken.
3. Combine flour with water, soy sauce, sugar, salt and ginger and pour over meat.
4. Replace casserole lid or cover with foil.
5. Bake at 180°C for 1 hour.
6. Serve with rice or staple and colourful vegetables.





## Lemon Marinade

### You will need

- 1/2 cup lemon juice
- 1/2 teaspoon dried thyme
- 1 teaspoon honey
- 1 teaspoon salt
- 1/8 teaspoon freshly ground pepper
- 1/3 cup water
- 1 tablespoon oil
- 1 clove garlic, cut into small pieces

### Method

1. Put all ingredients in a bowl and mix thoroughly or, if a blender is available, blend well.
2. Use to marinate meat pieces. Marinate for several hours before roasting.





### **Lime:** *Citrus aurantifolia*

Limes can be divided into two major groups: sour and sweet limes. Only the sour species are of horticultural value (Darley, 1993). The round, small variety known as the West Indian or Mexican or Key lime has thin, smooth rind with greenish flesh and few seeds. Another variety called the 'Tahiti' (*C. latifolia*) or Persian lime has a larger, seedless fruit and is believed to be a hybrid (Samson, 1986). Experiments have shown that limes grow well in some atolls, as in Kiribati (Baiteke, 1990), and can be grown from seedlings.



#### *Selection*

Choose firm fruits which are not fully ripe, with a greenish-yellow colour, juicy, not bruised, and with skin free from marks or infestation. To test for juiciness, lightly press the fruit with fingers — it should have a 'soft' feel.

#### *Storage*

Like lemons, firm, mature limes will keep at cool room temperature for one to two weeks. If stored covered in the refrigerator (in perforated plastic bags), fruits will keep for up to three to four weeks. Fruits that are not covered in the refrigerator will dry up and shrink fairly quickly. For longer storage, the juice can be frozen in ice-cube trays and then stored in plastic bags in the freezer.

#### *Preparation*

To prepare the juice, cut fruit in half, and extract the juice from each half by inserting a fork and twisting, or squeezing by hand, or using a lemon squeezer. The rind can be obtained by carefully grating off the coloured part of the skin, taking care not to include the pith, which is bitter. Cut thin slices for cooking and for garnishes. Serve wedges with fish.

#### *Food value*

The citric acid content of lime ranges from 7 to 8 per cent (O'Brien & O'Dea, 1987). The fruit is an excellent source of Vitamin C, and also supplies dietary fibre and small amounts of minerals and other vitamins (Dignan et al., 1994; Stanton, 1986).



### *Use*

Lime can be used whenever lemon and kumquat are indicated and vice versa (Darley, 1993), depending on availability and consumer preferences. The fruit can be used in many ways to improve food flavour and texture. The juice is used for making drinks, desserts and cake recipes. One of its major uses in the Pacific is as fish marinade. It is also used with other ingredients for marinating and flavouring meat and chicken and in dressings for vegetables. Limes contain pectin, which is required for jelling of jam made from fruits which lack jelling properties. The skin or peel can be used in the processing of marmalade, and the freshly grated rind is used to flavour cakes and desserts (Stanton, 1986). Limes also make good pickles. The leaves may be used to flavour curries and soups, and to make a hot 'tea' drink.







## Lime Syrup Pancake *(serves 6)*

### You will need

- 1 cup milk or thin coconut cream
- 1 egg (optional)
- 3 cups wholemeal or plain flour, sifted
- 3–4 tablespoons oil
- Juice of 1 lime
- 6 teaspoons sugar

### Method

1. Beat egg in a bowl, add milk or coconut cream and mix well.
2. Gradually add the liquid mixture to the flour and mix until a smooth batter is formed. Leave for half an hour.
3. Heat a frying pan, then add just enough oil to coat the base.
4. Add enough batter to thinly coat the bottom of the pan. Allow to cook for a few seconds until lightly browned at the bottom. Turn the pancake and brown the other side.
5. Turn over onto plate, place one teaspoon of lime juice in the middle and add one teaspoon of sugar. Roll and serve on a clean plate.



*Note:* Preserved toddy can be used in place of sugar. This dish can be eaten for breakfast.



## Lime and Orange Pudding *(serves 3)*



### Method

1. Beat egg yolks, sugar and juice together.
2. Soften gelatine in a little cold water, and fill cup to 3/4 full with boiling water.
3. Pour onto egg yolk mixture.
4. Add stiffly beaten egg whites and beat well before putting into a wet mould.
5. Cool to set. Serve cold.

### You will need

- 2 eggs
- 5 tablespoons sugar
- Juice of 1 lime and 1 orange
- 1<sup>1/2</sup> dessertspoons gelatine
- 1 cup water





### **Mandarin:** *Citrus reticulata*

Mandarins originally came from China (McGee, 1984; Stanton, 1986), and are widely grown in the Pacific. The fruits have a dark green colour when immature and may turn lighter green or yellow to orange when ripe. The flesh is orange and the fruit is generally slightly smaller in size than the orange. When mature or ripe, the fruits have loose skins that come away from the flesh easily, unlike the orange (Inglett & Charalambous, 1979). Mandarins have a distinct, pleasant flavour.



#### *Selection*

Mandarins have a short on-tree life, so the season is short (Samson, 1986). The best fruits are picked off the tree. They should not be allowed to drop on the ground when ripe, as this bruises the fruit. Select fruits that are ripe, firm, not bruised, and without blemishes on the skin. Bruised fruits tend to develop a bitter taste and they deteriorate more quickly. For jelly making, mature or under-ripe fruits are best because they have maximum jelling power (Charley, 1982).

#### *Storage*

Mandarins have a shorter shelf life than the other citrus. Wipe clean before storage. They are best stored in a cool environment. They may last a week if stored in the refrigerator. If longer storage is required, juice the fruit and store frozen.

#### *Preparation*

When fruit are to be eaten fresh, wash them well, peel, and remove as much of the white stringy veins as possible. If using in fruit salads, remove the thin membrane separating the sections to get rid of the bitterness. To extract juice squeeze by hand or use a squeezer.

#### *Food value*

Mandarins are very good sources of Vitamin C, carotene and dietary fibre. A normal-sized fruit would also provide approximately 190 kJ or 45 kcal (Stanton, 1986).



### *Use*

Mandarins are best eaten fresh. They make good snacks for both adults and children. Because of the pleasant flavour, mandarins can also be made into refreshing drinks, used as an ingredient in fruit salad and other desserts, or made into jams and preserves.





## Tropical Fruit Salad *(serves 4-6)*

### You will need

- 1 ripe mandarin
- 2 ripe bananas
- 2 ripe mangoes
- 1 small pineapple
- 1 medium ripe pawpaw
- Other available fruits
- 1/3 cup mandarin juice

### Method

1. Wash, peel, remove seeds of mangoes and pawpaw. Peel mandarin and remove seeds and membrane separating the sections.
2. Peel pineapple, chop and place at the bottom of a bowl. Arrange the layer of sliced banana next and add mandarin juice. This will help slow discoloration of bananas. Some sugar may need to be added to the juice to sweeten it.
3. Chop all other fruit into small pieces and add to the bowl.
4. Serve with freshly made thick coconut cream, or ice cream, or by itself.



*Note:* When using fresh pineapple and pawpaw in fruit salad, it is advisable to keep them separate during preparation because they tend to react and produce a bitter taste.



**Orange:** *Citrus sinensis*

The sweet orange variety is the most common. There are numerous cultivars. Probably the two most common ones in the Pacific are the navel and Valencia. Navel oranges are easily identified by their protruding navels and are seedless. The Valencia orange is a round, medium-sized fruit, usually with a dark orange rind and relatively high juice content (Samson, 1986). It matures at about seven to nine months, has seeds, and has a good but slightly acid flavour. Because of our tropical climate, the colour of the skin of the orange remains green. It can change from green to yellow. The orange colour does not develop at all (Darley, 1993).



The flesh of the Pacific orange is usually a pale yellow to light orange.

In atolls, such as Nukuoro Atoll in the Federated States of Micronesia, sweet oranges have been reported to be growing well. They have pink or red flesh.

*Selection*

Oranges vary in size. Ripe fruits are best because their sweetness has developed. The sweetness of the local oranges can vary considerably, so trial and error may be the only way. In some Pacific Islands, sweet oranges are known to come from or grow in specific parts of the country. Ripe local oranges have a pale green to yellow-green or completely yellow colour. The imported oranges are easier to identify because of their bright orange colour and are generally sweeter, but they are more expensive.

Freshly picked fruits are the best. The skin should be free from marks, and the fruit should be firm with relatively thin skin.

*Storage*

Wipe clean before storage. Fruits will last longer, up to two weeks, if stored in racks in a cool place. For longer storage, frozen juice is best. If fruit is stored at room temperature, use as soon as possible.

*Preparation*



Peel off skin and pith and separate the segments to eat fresh. For fruit salad, remove the membranes from each segment before adding to salad. To prepare juice, cut fruit in half and extract juice with a squeezer or a fork and use as desired. Orange rind is prepared by grating the outer skin.

#### *Food value*

Oranges are good sources of Vitamin C, carotene, dietary fibre, some minerals and small amounts of other vitamins. One local orange provides 234 kJ or 58 kcal (Dignan et al., 1994).

#### *Use*

Oranges are normally eaten fresh. They make good snacks. Oranges can also be used to make fresh juice. Freshly squeezed, undiluted juice may develop bitterness upon standing (Berry, 1979), so it should be used immediately. Commercially the bitter flavour can now be changed into a non-bitter substance by means of a bacterial enzyme (Samson, 1986). Orange can be used to flavour drinks, and in salads, desserts, cakes and main dishes.





## Chicken with Oranges *(serves 6)*

### You will need

- 1.5 kg chicken
- 3 tablespoons cooking oil
- 1 medium onion
- 2 cloves garlic, crushed (optional)
- 1 cup orange juice
- Salt to taste
- 3 oranges, peeled and sliced

### Method

1. Heat oil in a frying pan. Add chicken and cook until well browned on all sides.
2. Remove chicken. Pour off all but 2 tablespoons fat.
3. Add onion and garlic to oil, fry until onion is tender.
4. Add browned chicken, orange juice and salt to taste. Cook covered for about 45 minutes or until tender.
5. Serve with orange slices.







## Semolina Orange Syrup Cake



### You will need

- 150 g butter/margarine
- 3/4 cup sugar
- 2 eggs slightly beaten
- 1 1/2 cups semolina
- 1 cup ground nuts (any available)
- 1 1/2 teaspoons baking powder
- 1/4 cup milk
- 2 teaspoons grated orange rind

### Orange Syrup

- 1/2 cup orange juice
- Rind of 1 orange
- 1/2 cup sugar

### To make syrup

1. Combine juice, rind and sugar in a small pan.
2. Stir over a medium heat without boiling until sugar dissolves.
3. Bring to the boil, reduce heat, simmer 5 minutes.

### Method

1. Prepare cake tin and pre-heat oven to moderate (180°C).
2. Beat butter and sugar in a small bowl until light and creamy.
3. Add eggs gradually, beating after each addition. Add rind, beat well until combined.
4. Transfer mixture to a large bowl. Using a metal spoon, fold in combined semolina, nuts and baking powder alternately with milk. Stir lightly until smooth.
5. Spoon into prepared tin, smooth surface, and bake for about 45 minutes or until a skewer comes out clean when inserted into centre.
6. Leave cake in tin 5 minutes, then turn onto a serving plate.
7. Pour warm syrup over top of cake. Serve when cool.





### **Pomelo:** *Citrus grandis*

Pomelos are the largest of all citrus and have very thick pith. They are also known as pummelo or shaddock (Darley, 1993). They are a cross between a grapefruit and the tropical shaddock (called after the person who introduced the fruit to the West Indies). Pomelos are native to South East Asia and grow well in the tropical lowlands where the soil is fairly salty.



Pomelo is the largest tree and fruit of all citrus (Darley, 1993). The fruits can weigh as much as 1 kg or over and grow to a diameter of 250 mm or more (Samson, 1986). The larger the fruit, the thicker the skin. The smaller fruits (about

150 mm in diameter) tend to be better quality. Pomelos may have yellow, white, pink or red flesh, and may also be seedless, sweet or sour, but never bitter.

#### *Selection*

Choose firm fruits of uniform size with a pale yellow-green colour. The skin should be free from fruit-fly infestation.

#### *Storage*

It is best not to store fruits in bags, as this encourages bruising. Wipe clean and store on racks in a cool place. Cool weather improves storage life. For long storage, freeze juice. If picked well mature but not ripe, the flavour improves when stored for up to about four weeks after harvest.

#### *Preparation*

Pomelos are always peeled for consumption. Wash, and peel by cutting off the top and bottom, then making about six evenly spaced cuts through skin and pith down the fruit. Pull off each skin section one at a time, and separate the segments to serve as raw fruit. Or cut in half, separate segments with a sharp knife, remove with a spoon, and serve. For marmalade, cut half-ripe fruit into quarters, separate the skin from the flesh, remove seeds and pith from the flesh, and then slice flesh thinly. Scrape out the pith from the skin, slice skin thinly and combine with the prepared flesh.



### *Food value*

Like other citrus fruits, pomelo is a good source of Vitamin C and is regarded as a good food for those with diabetes. It is also a good source of potassium and beta-carotene.

### *Use*

In the Pacific, pomelo is eaten fresh as a snack. It also makes good breakfast fruit. Segments can be added to fruit and vegetable salads. The fruit also makes good marmalade. Pomelo juice can be used to flavour drinks. The fruit can take the place of grapefruit for breakfast.





## Pomelo and Green Salad *(serves 10)*

### **You will need**

- 1 large ripe pomelo
- 250 g Chinese cabbage or English cabbage
- 2 spring onions
- 1/2 cup French dressing

### **Method**

1. Wash and prepare pomelo.
2. Wash and shred cabbage.
3. Wash and cut spring onion.
4. Mix all ingredients in a large salad bowl and sprinkle with French dressing. Toss well and chill before serving.





## Pomelo Marmalade

### You will need

- 2 pomelos
- 1 lemon
- 1.5 litres water
- 6 cups sugar

### Method

1. Wash, dry and slice pomelo and lemon finely and place in a large pan.
2. Cover with water and leave overnight.
3. Next day, boil briskly until fruit is soft and pulpy — about 40 minutes.
4. Add sugar, bring quickly to the boil and boil fast until setting point is reached. Test.



#### 4. Coconut: *Cocos nucifera*

The coconut palm is probably the most valuable agricultural commodity of the Pacific. It is said to have more uses than any other living plant. Every part of the plant has some important use (Merlin et al., 1997; Pieris, 1955).

It provides food, drink and shelter. The importance of coconut as a food is illustrated in the fact that it is listed as a separate group of foods in the Pacific Islands Food Composition Tables (Dignan et al., 1994). It is a plant that is probably taken for granted by Pacific Islanders.



The coconut is a very hardy plant. It can grow well in all kinds of soil, even in poorer ones on atolls, and can stand some dry weather. Coconut palms adapt to the place where they are grown in terms of climate, soil and amount of water (Lambert, 1970). However, they grow best in mild tropical climates. Under good conditions, a fully productive palm yields 12–16 bunches of coconuts a year and drops as many leaves. The number of nuts in a bunch varies from season to season, but each bunch should carry 8–10 nuts or more (Pieris, 1955). Nuts are available throughout the year.

For commercial coconut plantations, coconut is propagated by seed-nuts chosen from the mother or parent palm. The shape and size of the nut is important. Experts say that the best nuts are round or egg-shaped. Medium or large size is best. The husk must be thin. Very large nuts have a lot of water with a thin kernel; long ones usually have too much husk. The leaves of a good parent palm should be evenly distributed on the crown, and should have short, broad stalks. If you stand at the foot of a healthy, high-yielding palm and look upwards through the crown, you should not see any light or the sky (Pieris, 1955).

Many different varieties now grow in the Pacific: the tall, the dwarf, and the cross between the tall and dwarf (Lambert, 1970). The colour of the young nut may be green, light yellow or orange-brick but all turn brown when mature. The size of the nuts varies from relatively large to fairly small (about the size of an adult's fist), depending on the variety.



The ripe or mature nut usually falls on the ground. The stage of maturity determines the use and nutritional value.



### ***Ingredients from coconut***

As an ingredient, coconut comes in a variety of products.

#### ***Coconut flesh — whole or shredded***

The fresh kernel of the mature nut is removed in strips from the shell with a knife. It can also be shredded using a shell, spoon or special grater. It is used as a snack, fresh or toasted or sprinkled on savoury or sweet dishes. The flesh of the green nut is thinner, softer, and is usually removed with a spoon after the water has been emptied or drunk.

#### ***Coconut cream/milk***

Cream is the white creamy fluid extracted from the grated kernel of the mature nut without water. When water is added to dilute it, it is sometimes called coconut milk and has the appearance of dairy milk. Both products are used extensively for cooking. Coconut cream/milk is now available in cans and packets in stores.

#### ***Coconut juice or water***

This is the colourless liquid contained within both the mature and young fruit. Green coconut juice makes a delicious, cool, fresh drink.

#### ***Desiccated coconut***

This is the commercially prepared product. It is the finely shredded, dried white flesh of the mature nut and is sold in stores.

#### ***Germinating nut***

This is the white 'germ' inside the mature nut that has been allowed to sprout. It is essentially the food of the new plant and is obtained by splitting open the sprouting nut.





### *Toddy*

This is the sap collected from the flower bud (spathe) of the coconut tree. It can be either fresh or preserved (syrup). Toddy is a common product in the atolls.

### *Selection*

#### *Mature nut*

Nuts are selected according to use. The un-husked nut should have a dry, light-brown outer skin. For husked nuts, choose the fresh, brown, newly husked ones with black eyes and without signs of sprouting. There should be plenty of water. If the nut has no water, or if it makes a heavy thudding sound when shaken, or if there are signs of sprouting, it should be rejected as it will not produce good-quality coconut cream.



#### *Green nut*

Young or half-mature nuts are also judged by the sound produced when flicked or tapped with the finger. The reliability of this method comes with practice and experience. Generally, a more muffled sound means the nut is not ready for drinking; it either has no flesh or the flesh is still very thin, and the water is generally tasteless. A lighter sound means it is a good drinking nut. The flesh will have been formed sufficiently, is still soft, and the juice is likely to have more flavour.

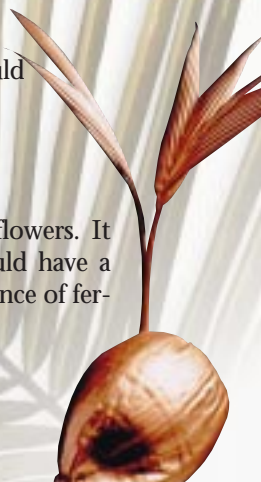


#### *Germinating nut*

Germinating nuts should be starting to sprout, but the nut should be easily picked off the ground. If the sprout is just starting to show, the germ will not have been fully formed.

### *Toddy*

Fresh toddy should be clean and free of insects and coconut flowers. It should not have any fermentation smell. Preserved toddy should have a thick but pouring syrup consistency. It should not have any evidence of fermentation.







### ***Storage***

#### ***Mature nut***

Storage life will depend on maturity. Mature or brown nuts will keep for a longer period (months) if un-husked, although they tend to sprout and dry out during long storage. Husked mature nuts do not keep so well. They must be kept in a cool place away from sunlight, preferably covered to prevent drying out and cracking. If stored this way, they may last up to two to three weeks.



#### ***Grated nut and cream***

Grated mature nuts and cream do not keep well at room temperature. They may last at the most a day or even less. If refrigerated, the cream may last two days while the grated kernel may last three to four days. They keep longer frozen.

#### ***Green nut***

Green nuts are best used soon after picking. If they have to be stored, keep in a cool place. If un-husked, green nuts can keep for three to four days after harvesting without losing flavour. However, husked nuts are best used immediately. They can keep for three to four days if kept in a cooler or refrigerator.



#### ***Toddy***

Fresh toddy must be used immediately after collection. If it is to last the rest of the day, it must be boiled to sterilise it. For longer storage, fresh toddy should be boiled and reduced to a thick but flowing syrup consistency, and stored in a sterilised bottle with a tight top. Check regularly for signs of fermentation and re-boil if necessary.

### ***Preparation***

#### ***Mature nuts***

Mature nuts are cracked in half by hitting the three veins with a cane knife or heavy instrument at the mid-point between the top and bottom. To ensure a clean, even crack, the first hit should always be on the vein that runs between the 'eyes'.



The two halves are then grated by hand, using a scraper with a rough, serrated tip. In some countries the grating is done by machine. Place the scraper on a box or low stool and put a bowl to collect the grated nut under the tip. To grate, sit on the body of the scraper and, holding the half nut with both hands, apply pressure on it and scrape, beginning at the outer edge and working towards the inner part. Repeat the action, rotating the nut after each scrape. Continue until all the kernel or flesh has been grated.

The water from mature nuts may be saved and used to mix with the grated flesh for making cream. Frozen, grated, mature nut needs to be thawed and brought to room temperature and mixed with warm water to extract the cream. While extracting the cream, stand the bowl of grated nut in a bowl of warm water to facilitate the process.



#### *Coconut cream*

This is made by kneading the grated nut and then wringing it, using a special wringer made from coconut or pandanus-root fibres, or a cloth. Thick cream is made without or with very little water and thin or diluted coconut cream (or milk) is made by kneading the grated flesh of one nut with about  $3/4$ –1 cup of water or more. To prevent fat separating and causing curdling during boiling, add about  $1/2$  tablespoon cornflour to every cup of cream. Mix well and heat until it begins to thicken before adding to the recipe. Frozen cream needs to be brought back to room temperature before use.

#### *Green nut*

There are several ways of preparing green coconut:

1. Cut the husk off the 'eye' end with a sharp, heavy knife and make a small hole to release the juice; or
2. Husk the nut and either pierce the big eye ('nose') with a pointed knife, or hold the nut upside down and cut the tip end off; or
3. Remove the husk from the bottom end with a sharp heavy knife and open it by cutting off the tip of the shell. The immature flesh of the nut can be removed by splitting the empty nut and scraping it out with a specially cut piece of green husk or spoon.



### *Germinating nut*

Cut the nut in half with a sharp heavy knife and remove the germ.

### *Toddy*

In the atolls, fresh toddy (*kavere* in Kiribati, *jekaro* in the Marshalls) is obtained by tapping the flower bud or spathe of the coconut (Parkinson et al., 1992). The flower bud is bound almost to the tip in a special way and the end trimmed off. A coconut shell or a container is hung at the end to catch the sap. Toddy is collected twice a day, early in the morning before sunrise and in the late afternoon after sunset.

Toddy-cutting is usually carried out by the young men. Fresh toddy is the basic product from which come other products such as *kamaimai* and *kareberebe* (Kiribati) or *jekmai* and *jelinan* (Marshalls). These are made by boiling the fresh toddy to reduce it to a thick syrupy consistency and further boiling to form toffee respectively.

### ***Food value***

#### *Mature nut*

Mature coconut is classified as an energy food. Coconut cream from the mature nut is high in energy (because of its fat content), is a good source of potassium and has some protein. One hundred grams of coconut without water provides 1350 kJ or 327 kcal; with water, it provides 1060 kJ or 258 kcal (Dignan et al., 1994). Mature coconut flesh also contains fibre. Coconut fat is one of the few plant fats that are predominantly saturated (Williams, 1993).

#### *Green nut*

Green nut is classified as a protective food when young or half-mature. Its juice has some energy because of its sugar content, is a good source of potassium and sodium, but contains little Vitamin C. One hundred grams of green coconut juice provides 93 kJ or 23 kcal (English & Lewis, 1991). The immature coconut flesh is a good energy source, a good source of potassium, and provides reasonable amounts of other minerals but has little protein and Vitamin C. One hundred grams of it gives 317 kJ or 77 kcal.





### *Toddy*

Fresh toddy also contains some energy, is a good source of potassium, has small amounts of the B vitamins and is a good source of Vitamin C (English et al., 1996). One hundred grams of fresh toddy provides 183 kJ or 44 kcal. Preserved toddy (concentrate) is a good energy source due to its high sugar content. It has little protein, is a good source of sodium and potassium, and has some Vitamin C. One hundred grams of toddy concentrate gives 883 kJ or 211 kcal. Fermented toddy contains similar nutrients, but in much smaller amounts than preserved toddy (English et al., 1996 ).

### *Germinating nut*

The coconut embryo (germinating nut) provides energy, some fibre, small amounts of the B and C vitamins, and protein. One hundred grams of coconut embryo provide 296 kJ or 72 kcal (Dignan et al, 1994).

### *Use*

The nut or fruit is a staple in the atolls and an indispensable food ingredient in the other islands. As a food, coconut has many uses. The fruit may be eaten at every stage of development. The mature (brown) nut, the green, the germinating nut, as well as the sap from the flower of the palm (toddy) are all used as food. In some countries (e.g. the Marshall Islands), the heart of the palm (*jiap*) is used for food, but restricted to special occasions since it necessitates the felling of a tree (Merlin et al., 1997).

### *Mature nut*

The flesh of the mature coconut is a staple food in the atolls and is usually eaten with fish. Coconut flesh can be eaten fresh or toasted as a snack, dried in flake form and used as ingredient in fruit mixes, grated and dried (desiccated) and used as flavouring in baked products and desserts. Grated mature nut is also fermented and used as flavouring in seafood and green leafy dishes. One of its major uses is for making coconut cream, which is used for cooking.



### *Coconut cream*

The cream squeezed from the freshly grated coconut is used extensively in most Pacific countries for preparing and cooking all types of dishes — from fish, green leaves and staples, to sauces and desserts. It is also used to make lemon flavoured sauce to serve with fish and other dishes. Coconut cream may be used to replace dairy cream, milk or liquid in recipes.

### *Green coconut*

Young or half-mature nuts are eaten as a fruit. Green nut water has numerous uses throughout the Pacific. It is used as fruit juice, alone or mixed with other fruit juice, and as fluid for oral rehydration to treat diarrhoea (South Pacific Commission, 1995). The soft flesh of the green nut is also eaten, used in fruit salads, and makes an excellent baby food. Green nuts make excellent snacks. In some islands, the husked green coconut is baked in the earth oven and given to women who have recently given birth. In the island of Rotuma in Fiji Islands and in French Polynesia, the green nut is fermented into a delicately flavoured sauce for seafood dishes.

### *Germinating nut*

When mature nuts are allowed to sprout, the embryo of the sprouting nut is eaten as fruit. The germinating nut contains an embryo, a cotton-like mass, that is eaten fresh as a snack, or eaten with the flesh of the coconut (South Pacific Commission, 1995). In the atolls, germinating nut may be scraped out of the shell, mixed with toddy and eaten with fish. It can also be boiled in coconut cream or baked. Boiled germinating nut makes a good soft food for young children and the elderly.

### *Toddy*

Fresh toddy can be mixed with water as a drink for all the family including infants. It can also be preserved as syrup (*kavere* or *jekaro*), which is also mixed with water as drink. It makes good toppings for desserts such as ice cream. Fermented toddy is used for marinating fish or, when left to ferment for a few days, as a potent alcoholic drink by young men.

### *Palm heart*

In some places, the heart of the palm is boiled and used in salads. Unfortunately, when the heart of the plant is removed, the palm dies.



### *Other uses of coconut*

The coconut plant has other uses. At the village level, the mature nut is processed to make body oil (scented or plain). As a commercial product, the kernel is removed and dried to produce copra, which is then processed to make coconut oil that is sold as cooking oil, or used for making soaps and other cosmetic products.

Coconut-husk fibre (coir) from the mature nut is used to make mattresses, while the husk of the green nut is traditionally used to make string or rope for house and boat building.

The half-shell of the mature nut is polished and used as a cup for drinking kava, and the half-shell of the green or half-mature nut is polished and used as a fish-soup cup. The whole shell is used as a water-carrying container. Today, the shell is used to make utensils, ornaments, jewellery and other items.

The green leaves are used for thatch, walls, mats, baskets, fans and hats, while the midrib is used to make brooms (South Pacific Commission, 1995). Very young coconut leaves produce very fine white mats, baskets, hats and fans.

Coconut timber is an excellent product for houses and furniture because of its hardness. Its commercial value as building and furniture material has not yet been fully recognised by Pacific Island countries.



## Coconut Mint Chutney



### Method

1. Put coconut in a blender and add onion, chilli, salt and well washed coriander leaves.
2. Blend till all ingredients are finely chopped. Chutney should become a pale green colour.
3. Add lemon juice and stir well just before serving.
4. This chutney goes well with any curry.

### You will need

- 150 g freshly grated coconut
- 1 onion, chopped
- 1 cup coriander leaves
- 1 <sup>1</sup>/<sub>2</sub> teaspoons salt
- 2 tablespoons lemon juice
- 1 chilli (*optional*)



## Prawns in Coconut Cream/Milk *(serves 2)*



### You will need

- 750 g medium green prawns
- 1 tablespoon oil
- 2 cloves garlic, crushed
- 1 teaspoon turmeric
- 1–2 red chillies, seeded, chopped (*optional*)
- 8 curry leaves
- 2 medium onions, sliced
- 2 cups coconut cream/milk
- 1/2–1 teaspoon salt

### Method

1. Peel and de-vein the prawns.
2. Heat the oil in a pan, add onion and cook until soft. Add garlic, chilli, turmeric and curry leaves. Stir over medium heat for 1 minute.
3. Add coconut and salt. Simmer over low heat for 10 minutes.
4. Add prawns and stir gently. Simmer for another 10 minutes or until the prawns are tender. Serve hot.





## 5. Mango: *Mangifera indica*

Mango is one of the most delicious, aromatic and tasty fruits widely grown in the Pacific. The trees are said to have originated from India, Burma and Malaysia, where they were cultivated 4,000 years ago (Samson, 1986; Stanton, 1986).

The mango is a member of the cashew family (Samson, 1986). It can grow to about 15–18 m (50–60 ft) high and has narrow, dark green leaves. Mangoes are normally grown from grafts or budded plants. After about six years the tree will begin to fruit.



Different varieties are found in the Pacific. The fruits are round or oval. They vary in size, but usually weigh 250–800 g and are about 100–125 mm (4–5 in) long and 50–75 mm (2–3 in) in diameter. When ripe the skin colour may remain green or turn from green to a yellowish, orange or red colour. Mango is very seasonal and usually ripens during the summer months.

Ripe mangoes are very juicy and sweet. Some varieties may be stringy or have a turpentine-like flavour. These were identified as wild varieties common in the early days (Jardin, 1974). Those with very short fibres and smooth textures are more popular than the stringy varieties.

### *Selection*

The choice of fruit depends on the intended use. Varieties with small seeds and lower fibre content are probably best. All fruits should be firm and free of bruises and blemishes. In addition, ripe mangoes should be wholesome, and have a good colour and a sweet, fresh mango smell. Try one and cut it open to determine the quality before buying a larger quantity. Mature, unripe mangoes should be undamaged, without bruises and should still be very firm. In our climate it is best to get half-ripe fruit and complete the ripening under controlled conditions. When picking fruit, care must be taken to wash the sap off the skin, because it is caustic (Darley, 1993).



### *Storage*

Store half-ripe fruits in a well-ventilated place. Fruits are best placed in single rows on wire shelves covered with cloth to prevent bruising. Ripe fruits are best stored covered at 10–13°C for a number of days (Darley, 1993; Parkinson, 1989). For longer storage, store the sliced flesh or puree in the freezer. Sliced flesh can also be preserved by drying or bottling.

Mature or unripe mango can be stored at room temperature for a few days before ripening. It can also be refrigerated for up to two weeks before ripening at room temperature.

### *Preparation*

Wash fruit well before use. Mangoes can be eaten with the skin, but are nearly always peeled before use. The skin of mature or half-ripe fruits is removed with a sharp knife, starting from the wider end and working towards the tip. Subsequent preparation will depend on intended use.

To prepare ripe mango without peeling, slice off the 'cheeks', and then the two narrow sides. Make a few lengthwise cuts in the flesh without cutting the skin, and peel the skin back from the flesh. Alternatively, cut into cubes without cutting the skin, hold the 'cheek' by the edges with both hands, push the centre of the skin to form a hollow and allow the cut flesh to pop up. This makes eating or removing the flesh easier.

Puree the cut flesh if needed. The flesh of damaged fruits can be sliced and made into drink. Mature or half-ripe fruits can be peeled, grated and used as desired.

### *Food value*

Mango flesh is an excellent source of Vitamin C and carotene. The fruit also contains small amounts of potassium, other minerals and vitamins. One hundred grams of ripe mango flesh provides 268 kJ or 65 kcal and about 41 mg of Vitamin C (Dignan et al., 1994).

### *Use*

Ripe mangoes are eaten raw, used in drinks, salads and cooked desserts, or made into jam. They can also be used as part of a main dish, for garnish, to enhance flavour and provide colour. Unripe mature mangoes can be grated and mixed with freshly grated coconut to produce a delicious dessert or a drink. Green mangoes are also used in curries, salads and to make chutneys.



## Fresh Mango Salsa

### You will need

- 1 onion
- 2 ripe mangoes
- 1 teaspoon chopped lemon grass
- 1 teaspoon grated root ginger
- 1 tablespoon chopped fresh coriander or parsley
- 2 tablespoons lime juice
- 1 teaspoon grated lime rind
- 2 teaspoons sweet chilli sauce

### Method

1. Peel and finely chop onion. Peel mangoes, remove flesh and dice.
2. Combine onion, lemon grass, ginger, chilli and other ingredients.
3. Chill for 1 hour.





## Barramango *(serves 4)*



### You will need

- 800 g reef fish fillets
- 2 large, fresh, ripe mangoes
- Flour
- Oil
- 50 ml sweet vinegar or dry white wine
- 200 ml coconut cream
- Seasoning (salt, pepper)

### Method

1. Cut fish fillets into four, wash and dry. Peel and slice mangoes and set aside.
2. Flour the fish and pan-fry in a little oil until cooked, or grill if desired.
3. Remove fish from pan. Pour wine or vinegar into the hot pan. Add coconut cream. Season to taste.
4. Place the fish on a plate and decorate the top with sliced mangoes.
5. Pour the sauce gently over the mangoes and the fish and serve immediately.





## 6. Pandanus: *Pandanus tectorius*

The pandanus plant or screw-pine of the Pacific is the unique, exciting, traditional food plant of the atolls. In I-Kiribati mythology it is said to be an ancestral tree (Baiteke, 1990).

Pandanus trees thrive on sandy soil and are found along the coast of most Pacific Islands, including the Marshall Islands, Kiribati, Papua New Guinea, New Caledonia, Fiji Islands and many parts of Polynesia. They can also be found at altitudes of up to 3,000 m (10,000 ft) near streams and creeks.

The plant belongs to the family Pandanaceae. There are three major groups: *Pandanus tectorius*, *Pandanus jiulianetii*, and *Pandanus conoideus*, and more than 200 species. In Papua New Guinea, the species most commonly used is *Pandanus jiulianetii*.

The different varieties in the Pacific are identified by their local names and characterised by their appearance and the size, shape and colour of the pandanus bunch and individual fruits. Other distinguishing features include flavour, water content and ease of detachment from the bunch.

In the Marshall Islands, where pandanus is known as *bop*, approximately 150 indigenous varieties were identified during the early 1970s (Hiyane, 1971). The size and shape of pandanus trees varies. Some branch out horizontally (*Lajokorer* variety) others at an angle (e.g. *Joibeb*). These two varieties, *Lajokorer* and *Joibeb*, are most commonly found in the Marshalls. Some trees can grow to about 5 m (16 ft) high and are branchless. Others can grow to a height of 10–13 m (30–40 ft) (Hiyane, 1971). Certain varieties are sweeter and more tender than others. Not all species of pandanus are edible in Kiribati.





The edible variety, *Pandanus tectorius*, is widely distributed. It flowers early in the year and takes approximately six months to reach maturity. The peak of the season is around December and January. A healthy mature tree normally produces 6–12 bunches during one season.

The pandanus fruit grows in a large, oval head or bunch that is made up of several small tiny fruit fingers (phalanges), all hung together in a cluster. These phalanges break up into individual pieces or fingers when ripe. Each finger weighs 60–200 g or 2–4 oz (Hiyane, 1971).

The plant can be propagated from cuttings. In the Marshalls, the edible varieties are grown from cuttings with roots because these have been found to grow much faster (Hiyane, 1971). Before the cuttings are planted, the leaves are trimmed off. This helps to reduce loss of water from



the young shoot. Longer roots are trimmed to ensure that they can fit well into the planting hole. Sometimes compost is added to the hole before planting. Once established, pandanus plants normally take five to six years to produce fruits. However, some varieties may flower sooner. The cultivated trees are well looked after in the Marshalls.

In Kiribati, pandanus mostly grow along the beach and do not need a lot of looking after.

### *Selection*

Pandanus fruit is ready to eat when the green head of the phalanges separates out, displaying the bright orange colour of individual fruit, with a very sweet characteristic smell. Each finger can easily be pulled off the bunch.

### *Storage*

Fresh fruits are best left on the bunch. Individual fingers can be then be picked and eaten. Ripe bunches do not last well, so the fruit should be eaten or used as soon as possible. If longer storage is needed, the fruits are stored in baskets hung under the roof of the cooking huts, where they are preserved by the heat and the smoke from the fireplace. They are also stored as a dried paste made from the thick pulp squeezed from the ripe phalanges.





### *Preparation*

Phalanges should be washed before they are eaten raw. The tougher varieties are normally boiled or baked. The surface of each phalange is rough and covered by small round projections.



The paste made by extracting the pulp from the fleshy part can also be dried in the sun after cooking, or mixed with coconut cream.

Pandanus seeds have a pleasant flavour and are rich in oil. The fresh seeds may contain oxalate crystals, a substance which causes itchiness when the seeds are eaten raw.

The seed can be difficult to extract, as it is protected by a very hard shell. A strong knife can be used to open it. When the fruit is opened it shows a series of small, grey, narrow, oval holes packed together and containing an oily juice. This juice may be sucked from the seed when ripe and has a fruity, winey smell. If the seeds are to be cooked, they are usually first washed in seawater to remove some of the oxalates.

### *Food value*

Pandanus fruit is a very good source of Vitamin A (as beta-carotene) and dietary fibre. It is also a good source of thiamin, riboflavin, and niacin (Dignan et al., 1994). The Vitamin C content is not as high as in most fruits. However, if large amounts are eaten (as they would be in most atolls), pandanus can be a very good source of Vitamin C.

### *Use*

The ripe fruit can be eaten raw or prepared in many forms (Baiteke, 1990). The fleshy part can be eaten fresh or cooked as a snack. It can also be pounded, the thick liquid extracted, mixed with coconut cream or grated coconut into a paste and then formed into small, thin, round cakes. The cakes can be baked and then mashed into a powder which can be eaten on its own or mixed with other foods such as the fresh coconut sap or toddy. The paste is also used for medicinal purposes.

In the Marshalls, only certain varieties of pandanus fruit are normally eaten raw. These are the ones with soft, sweet pulp, known as *Joibeb*, *Mijel*,



*Utottot* and *Edwaan-en-an-nelu*. The end of the fruit is sucked or chewed. It is very fibrous and this can be quite uncomfortable for some, but it may help clean teeth. For this reason, people sometimes refer to pandanus as the 'dental floss fruit'. The roots, the pith, the bulb, seeds and kernels and the floral bracts of the pandanus tree are also used as food in the Marshalls (Hiyane, 1971).

In some islands pandanus is not normally eaten unless there is food shortage. It is referred to as an emergency or famine food.



#### *Other uses*

The pandanus tree is also important as building material and for crafts. The timber is used for building. The dried leaves are used for thatching traditional houses. The green leaves are processed and used for weaving mats, baskets, fans, hats, canoe sails and a whole range of other handicrafts. Fine mats are made from special varieties of pandanus. The quality and fineness of mats reflect the variety and method of preparing the leaves.



## Tuae (a Kiribati recipe)



### You will need

- Ripe pandanus

### Method

1. Wash and place pandanus phalanges in a big pot. Add water and boil until soft.
2. Cool. Scrape the juice out of each phalange with a shell or a home-made implement and collect in a bowl. The juice should be thick. Strain to remove fibre.
3. Spread clean leaves on mat in the sun. Pour juice on leaves to make a rectangle and dry in the sun.
4. When dry, turn over to another mat. Continue to dry until all the moisture has been removed and paste is completely dry.
5. Store for later use.





## Roro Tuae

### You will need

- *Tuae*
- Fresh coconut cream

### Method

1. Soak *tuae* in thick coconut cream until the cream has penetrated the *tuae*.
2. Leave overnight before serving.





## 7. Pawpaw (papaya): *Carica papaya*

Pawpaw is a delicious breakfast fruit. It originated in tropical America (Stanton, 1986) and, due to its versatility, spread as far as the tropical isles of the Pacific. Pawpaw is also known as papaya, *lesi*, *esi*, *maoli*, *olesi*, *popo*, mummy apple and by many other names (South Pacific Commission, 1992). Pawpaws are abundant throughout the Pacific, even in some atolls. They come in various sizes and shapes and colours.



There are generally three types of pawpaw trees: the female, which can bear fruits provided the pollen comes from the male tree nearby; the male pawpaw tree, which has flowers on long stalks and generally does not bear fruit but provides the pollen for the female; and the hermaphrodite tree, which has both male and female flowers and can bear fruit on its own. In recent years new varieties have been introduced from Hawaii. These produce fruits of uniform size, texture and flavour.

Pawpaw can be grown in backyard food gardens from seeds or from seedlings distributed by agricultural extension officers. The pawpaw tree takes a year to start bearing fruit. The fruit normally turns from dark green to yellow/orange/pink when ripe (Samson, 1986).

Fruits are available throughout the year but are more abundant in the hot summer months. In the markets they are sold by weight, individually or in baskets.



### *Selection*

Ripe fruits are soft and easily bruised. It is best to select pawpaw fruits that are firm and yellow-green and then ripen them at home. Choose fruits of uniform size suitable for serving in halves or quarters. The Hawaiian variety, *Sunrise*, is small and pear-shaped with pinkish flesh. For cooking with fish and for chutneys, mature fruits with or without hints of yellow streaks are best.

### *Storage*

The fruit has a very short life. Yellow-green fruits ripen in one to two days at room temperature. Ripe fruit will last in good condition for three to four days if stored at 5–7°C (Parkinson, 1989). They should be arranged in a single row on a rack. For longer storage, puree the flesh of the fruit or cut into cubes and freeze. Frozen fruits will become very soft.

### *Preparation*

To serve as raw fruit, wash well, cut in half and scoop out the seeds. Season with lemon juice and serve. Alternatively, score the flesh into cubes with the tip of a sharp knife, without cutting the skin, and scoop out the flesh. Firm, ripe pawpaw can also be cut into fruit balls.

To peel green, under-mature or half-ripe pawpaw, cut off the stalk end, stand upright and peel downwards, using a sharp knife. Cut in half and remove pith and seeds. Cut the flesh into strips or cubes or grate coarsely into fine strips for salad. When peeling green pawpaw, care must be taken, because the sap can cause itchiness to the skin.



### *Food value*

Pawpaw is an excellent source of Vitamin C. It is also a good source of Vitamin A (beta-carotene) and dietary fibre and contains small amounts of minerals and vitamins. A 100 g portion of pawpaw contains 73 mg of Vitamin C and 207 kJ or 50 kcal (Dignan et al., 1994).

### *Use*

The ripe fruit is best eaten raw as fruit for breakfast or as a snack. It is a tasty and colourful addition to fruit salads. It can be made into drinks, sorbets,



and other traditional dishes such as desserts and preserves (South Pacific Commission, 1992). Ripe pawpaw is a good first food for young babies who have just started on solid foods.

The green flesh of the unripe pawpaw can be sliced or grated and mixed with a dressing to make a tasty salad, or can be cooked like a squash. It can also be cooked with fish in coconut cream when green leafy vegetables are scarce. The seeds can be ground and used with a vinegar sauce as a dressing.

Dried ripe pawpaw is commercially produced and sold as a snack.



#### *Other uses*

The leaves or the green pawpaw contain an enzyme called papain, which is used as a meat tenderiser in the Pacific. The leaves were used as a traditional wrapper for meat, fish and other foods until the discovery of aluminium foil.



## Baked Pawpaw *(serves 4)*



### Method

1. Cut off the stalk end of the pawpaw and scoop out the seeds.
2. Add sugar to the coconut cream, stir well and pour the cream into the prepared pawpaw.
3. Stand the pawpaw in a baking dish and bake in a moderate oven until soft.

### You will need

- 1 half-ripe pawpaw
- 1 freshly grated coconut, made into thick coconut cream with 1/4 cup of water
- 1 tablespoon sugar





## Pawpaw Salad *(serves 4)*

### You will need

- 1 small mature, but not ripe, pawpaw
- Salt to taste

### Method

1. Peel and dice pawpaw into bite-size pieces or coarsely grate.
2. Boil in salted water until cooked.
3. Drain and serve with chopped spring onion.

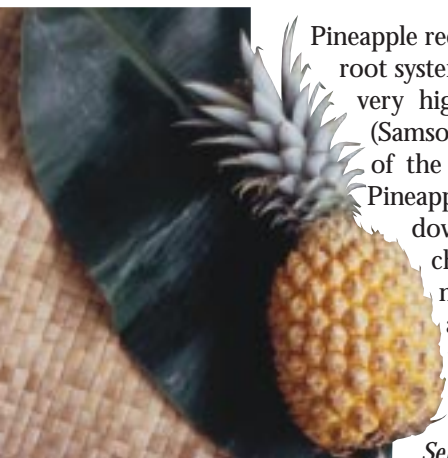
*(This can also replace leafy greens in fish-and-coconut-cream dish.)*





## 8. Pineapple: *Ananas comosus*

Pineapple belongs to the Bromeliaceae family, which originated in the American tropics (Samson, 1986). It is a herb-like plant with long narrow leaves. Each plant flowers and fruits only once and dies after fruiting. The fruit looks like a spinning-top with scaly skin. Two varieties are normally used. These are the Ripley Queen, which has rough, prickly leaves, and the Smooth Cayenne variety with smooth leaves (Carlos & Ooi, 1987).



Pineapple requires well-drained, composted soil. Because the root system of pineapples is shallow, they can be grown at very high planting densities on hillsides or flat land (Samson, 1986). They are grown from suckers or tops of the mature fruits after they have been harvested. Pineapples require plenty of attention to keep weeds down. Mulching is a good way to keep the weeds in check (Landauer & Brazil, 1990). After about 18 months, they will produce fruits. Pineapples can also be made to fruit during the off-season through the use of chemicals, in order to fetch higher prices in the market.

### *Selection*

Pineapple must be properly ripe to develop its sweet taste. When the fruit is not ripe, it tastes acidic or sour. When selecting pineapple, choose whole-some, freshly picked ripe fruit, not deformed, either evenly yellow-green or yellowish at the base and greenish towards the top end of the fruit. Check that the base is freshly harvested. The fruit should be firm all around, with a fresh, sweet pineapple smell and not smell rotten or fermented.

Yellow–orange coloured fruits tend to be over-ripe. If the fruit has an ‘off’ or slightly fermented smell, or the base looks old, it should be rejected. The Smooth Cayenne’s larger fruit, with smooth skin, is juicier than the Ripley Queen, which is rough-skinned but sweeter. When choosing Smooth Cayenne, select firm fruits that are reddish-yellow in colour. Do not cut unless the fruit is fully ripe, as the green fruit has a poor flavour. Most pineapples sold in the Pacific Islands are harvested mature.





### *Storage*

Mature fruits will change colour in storage. Stand the fruit upright in a cool, ventilated area. Under cool conditions, pineapples will keep for two to three days. Deterioration occurs quickly above 20°C (Darley, 1993). For longer storage, remove tops and keep cool. Pineapple can be cut into cubes and deep-frozen. Prepared slices and crushed pineapple can be preserved by bottling or by stewing and then freezing.

### *Preparation*

Remove the top and base of the fruit and cut downwards with a sharp knife. Remove the 'eyes' by cutting diagonal wedges about 1/2 - 3/4 cm in a spiral around the fruit. Cut fruits in halves or quarters or into round slices. Remove core if desired and serve.

Fresh pineapple contains a substance called bromelain that can produce a bitter taste when pineapple is mixed with fresh pawpaw and left to stand. Therefore the two fruits should not be mixed until just before serving. Bromelain is made inactive by cooking.

### *Food value*

Pineapple provides Vitamin C, dietary fibre and small amounts of minerals and vitamins. A hundred grams of pineapple provides approximately 22 mg of Vitamin C and 214 kJ or 52 kcal of energy (Dignan et al., 1994). To take advantage of the Vitamin C, pineapple is best eaten fresh.

### *Use*

Ripe pineapple fruit is usually eaten fresh. It is also used as an ingredient in fruit salads, drinks, cooked desserts and savoury dishes. The fruit can be processed into juice and dried into glazed pineapple pieces.

The bromelain in pineapple allows the fruit to be used as a meat tenderiser. Bromelain is only present in raw, fresh pineapple (Potter & Hotchkiss, 1998). A marinade is usually prepared by mixing cooking oil with lemon juice and slices of pineapple. Meat is then added to the mixture and left to stand for two hours before use.

This tropical fruit has also been grown for export in some parts of the Pacific Islands. For example, the Cook Islands and Fiji Islands exported the fruit during the 1960s (Carlos & Ooi, 1987).



## Pineapple Chicken Casserole *(serves 2)*

### You will need

- 500 g chicken pieces
- 1 tablespoon soy sauce
- 1 tablespoon white wine
- 1 clove garlic
- 1/2 teaspoon crushed ginger
- 1/4 tablespoon curry powder
- 1/4 teaspoon mixed herbs
- 1<sup>1/2</sup> tablespoons flour
- 1/4 teaspoon black pepper
- 1/4 teaspoon salt
- 1 tablespoon oil
- 1 cube chicken stock
- 1 medium onion, sliced
- 1/4–3/4 cup pineapple pieces

### Method

1. Put chicken pieces in a large bowl. Mix together soy sauce, wine, crushed garlic and ginger, curry powder and herbs. Pour over chicken and leave for several hours, turning once or twice.
2. Drain off marinade and keep.
3. Mix flour with salt and pepper. Dip chicken in flour mixture.
4. Heat oil in a pan and brown chicken pieces on both sides. Remove and put aside.
5. Cut onion into rings and fry in hot oil in which chicken had been fried until golden brown, drain.
6. Place chicken in a casserole. Mix chicken stock with remaining marinade, pour over chicken.
7. Arrange onion rings and pineapple pieces on top.
8. Bake in medium oven for 1 hour or till chicken is tender and pineapple slightly brown. Serve <sup>1</sup>





## Pineapple Punch

### You will need

- 8 cups of tea
- 1 cup lemon/lime/kumquat juice
- 4 cups sweetened pineapple juice
- Large bottle of ginger ale
- Ice
- 1 sliced lemon
- 4 slices of pineapple cut into wedges
- 4 sprigs of mint

### Method

1. Put tea, lemon juice and pineapple juice in a jug, and chill well.
2. Leave covered for an hour, and add chilled ginger ale just before serving.
3. Serve with plenty of ice, and lemon slices, pineapple pieces and sprigs of mint.





## B. MINOR FRUITS

The fruits contained in this group are not so widely or commonly grown. They include custard apple, guava, jack fruit, jambolan or jamun, *kavika*, lychee, *nandau*, passionfruit, star fruit, tamarind, *tarawau*, watermelon and *wi*.

### 1. Custard apple and soursop: *Anona* species

Custard apples are amongst the many exotic fruits grown in the Pacific. These white-fleshed, delicious fruits, with custard-like consistency, have a fragrant sweet, slightly acidic flavour sometimes described as a cross between a strawberry and pineapple (Stanton, 1986). The fruit contains many black or dark-brown seeds.



Custard apples belong to the Anonaceae family and are native to South America. Four species are commonly cultivated in the Pacific: *Anona muricata* (soursop), *Anona squamosa* (sweet sop), *Anona cherimolia* (cherimoya) and *Anona reticulata* (bullock's heart) (Landauer & Brazil, 1990). Various hybrids are also available.

The fruit has a short season — around the cooler months of May to August. There are a number of varieties growing in the Pacific.

The most commonly eaten varieties in the Pacific are the sweet sop (commonly known as custard apple) and the soursop. Soursops are medium-dark green, irregular, oblong fruits, with shiny curving spines, and are usually much larger than custard apples (Rare Fruit Council, 1981). They grow well in atolls such as in Kiribati. Custard apples need fertile, well-drained soils and moderate, well-distributed rainfall. They require protection from wind damage, to which they are very susceptible.

#### *Selection*

Fruits should be fully formed. The mature soursop fruit changes colour from a dark green to lighter green or yellowish-green. The gaps between the scale-like skin of the custard apple expand, indicating maturity



(Samson, 1986). The fruit should be harvested at this stage and ripened in a dark place. When ripe, the fruit becomes quite soft. Over-ripe fruit develop a darker skin.

### *Storage*

Ripe fruit does not keep well and should be eaten fresh as soon as possible if there is no cool storage. If stored, mature fruits should be kept on racks in a cool place. Storage at 15°C is best (Darley, 1993). Ripe fruit may be kept for about two days in cool storage, but the skin turns into an unappetising dark-grey colour. It is best to remove the skin and store the segments in a covered container till needed. Segments and the strained, creamy juice can be frozen for future use.

### *Preparation*

Wash fruits to remove dust and insects. If eaten fresh, cut the fruit into quarters or serving sizes and serve. Alternatively, remove flesh segments from the skin, remove the seeds and serve. Segments can be blended and strained, then used as desired.

### *Food value*

This group of fruits contains reasonable amounts of Vitamin C and minerals (Dignan et al., 1994).

### *Use*

Both sweet sop and soursop are eaten fresh as a snack. The fruits are seldom cooked. The puree or creamy juice is used fresh or may be used cooked as an ingredient in desserts. It is also used to make refreshing drinks, by itself or with other fruits. It is not suitable for inclusion in fruit salads because it contains a lot of soft fibre.





## Sop Drink



### Method

1. Mix sop puree with half water and the lemon juice, chill.
2. Make syrup with remaining water and sugar. Cool and add to sop mixture.
3. Serve chilled with sprig of mint.

### You will need

- 1 cup sop puree
- 1 cup water
- 1/4 cup lemon/lime/kumquat juice
- 2 tablespoons sugar





## Soursop Sorbet

### You will need

- 1 cup sugar
- 1 cup water
- 1/2 cup lemon juice
- 1 egg white
- 2 cups soursop puree

### Method

1. Mix sugar and water and bring to the boil. Boil 5 minutes and cool.
2. Add lemon juice and soursop puree.
3. Beat egg white till thick and gradually add some of the fruit mixture, beating all the time.
4. Fold in the remaining fruit, pour into a freezer tray. When half-frozen, take out and beat well.
5. Return to tray and freeze till firm.





## 2. Guava: *Psidium guajava*

This delicious small fruit tastes like a mixture of bananas, strawberries and pineapple and when ripe it feels like a pear! It is the oldest and the most common introduced wild fruit in many parts of the Pacific, including some atolls. Guava has a very distinctive aroma.

Guava is one of the most important members of the family Myrtaceae. It is indigenous to the American tropics and was probably spread to the shores of the Pacific Islands around the mid-1800s by migrating birds. The plants can survive a wide range of soil types, including poor sandy soils. They are very hardy and can tolerate a wide range of climates, including very low temperatures (Samson, 1986). However they thrive better under warmer conditions and require approximately four to six months of warm weather for the fruits to develop and mature successfully.

Guavas were introduced into different islands and have spread in the wild to the extent that they have become a pest in some of the dry parts of Fiji and New Caledonia (Barrau, 1955). Records show that they grow well on fertile areas in Kiribati, and were being propagated for sale to the public in the early 1980s.

There are two varieties in the Pacific, the true guava (*Psidium guajava*), which is the common variety, and the Cattley or cherry/strawberry variety (*Psidium cattleianum*) (Landauer & Brazil, 1990). The fruit of the common variety is larger than the cherry variety. It is oval and about 4–8 cm long. The main fruiting season is usually between February and April.







### *Selection*

When the guava is mature, its colour turns light green or yellow. The pulpy flesh may turn pink when ripe or may remain white in some varieties; there are many tiny hard seeds. Ripe fruit becomes soft, bruises easily, and ferments readily.

When selecting guava, choose ripe, firm fruit with pale greenish-yellow colour and clean skin, with no blemish, and without signs of worm infestation. Half-ripe fruits are the best choice. If the fruits have ripened on the tree, they should be clean and free of fruit-fly infection. The smaller, wild variety often has better colour and flavour. Fruits of hybrids are larger. Fruits for jams and jellies should be under-ripe.

### *Storage*

Store fruit spread out on racks in a cool place. For longer storage refrigerate whole fruit at 8–10°C (Parkinson, 1989). Alternatively, it can be frozen in the following forms:

- blanched (for 3 minutes) half-ripe fruit cut into sections, with pulp removed and drained,
- cooked pulp, sieved to remove seeds,
- juice from fruit that has been boiled and strained.

### *Preparation*

This depends on the use. For eating raw, wash well and trim rose-end. For other uses, the fruit may be peeled or used with the skin, pulped and strained to remove the seeds. Fruits can also be stewed whole. With seeds removed, guava tends to become soft and break up easily when cooked. To use in desserts, wash, peel (if preferred), cut into quarters, remove pulp or inside and discard, and cut into suitable sizes.

For drinks and puree, wash fruits, cut up and pulverise, using a blender. Guava can also be stewed with water, a little sugar and lemon juice until soft before pureeing for use in desserts or for storage. To stew fruit, wash, peel and cut fruit into appropriate bite sizes, add enough water to cover the fruit, sugar to taste and lemon juice or a few cloves, and cook until fruit is soft.



### *Food value*

Guava is an excellent source of Vitamin C. It is also a good source of dietary fibre, carotene and potassium (Dignan et al., 1994; Stanton, 1986). Guavas appear to be a good potential source of C, A and B vitamins in atolls.

### *Use*

The fruit, including the skin, is very crunchy when fresh and makes an excellent snack. The milder, sweeter fruits are usually eaten fresh; the more acid fruits are more suitable for jelly making since they have a higher pectin content (Stanton, 1986). Guavas can be processed into juice. They can also be stewed, or pureed, or dried into a delicious snack. People with digestive problems should not eat whole guavas.





## Guava Cake

### You will need

- 1 cup unsweetened guava pulp
- 1<sup>1/4</sup> cups sugar
- 1/2 cup margarine
- 1 egg
- 1<sup>3/4</sup> cups flour
- 1/4 teaspoon salt
- 1 teaspoon baking soda
- 1 teaspoon cinnamon
- 1/2 teaspoon cloves
- 1/2 cup raisins or sultanas
- 1/2 cup chopped nuts (any available)

### Method

1. Measure 1/4 cup sugar and add to guava pulp.
2. Heat to boiling point and cool.
3. Cream margarine and remaining sugar. Add egg and beat thoroughly.
4. Sift together flour, salt, soda and spices.
5. Add sifted flour to creamed mixture, then add sultanas and nuts.
6. Add guava pulp and beat until smooth.
7. Pour into an oiled 20 cm square tin and bake at 180°C for 40–45 minutes.
8. Serve warm, plain or with ice cream.





### 3. Jack fruit: *Artocarpus heterophyllus*

A cultivated species from India and Malaysia (Stanton, 1986), jack fruit is widely grown in some parts of the Pacific, especially Fiji Islands. The fruit is unusual in that it is borne on the trunk and main branches. It is the largest edible tree-grown fruit, weighing up to 20 kg each, and pale green in colour. The fruit is mature for harvest when the single small leaf on the stem above the fruit withers and the first colour changes can be seen (Darley, 1993). The mature fruit is yellowish-green and has a tough, rough skin. When ripe, the skin turns yellowish-brown and the fruit softens a little. This ripening process takes up to six to eight months. Ripe fruit gives off a musty, sweet aroma for a day or two before it is best to use (Darley, 1993). The yellow flesh has a very strong smell, and is very juicy. The fruits are available throughout the year but are more plentiful in the hot season (December to March).



#### *Selection*

Jack fruits can be sold whole or in sections. Choose fruit with a uniform shape, unblemished skin and of a suitable size. Mature fruit have a greenish-yellow colour and should be firm if they are to be used for cooking. For ripening, choose fruits that have a more yellow colour and sound hollow when tapped or thumped (Parkinson, 1989).

In some places, the flesh of the half-ripe jack fruit is cleaned and cut up ready to use and then sold. In these instances, ensure as far as possible that it has been prepared in a hygienic environment and packed in clean containers.



### *Preparation*

Green jack fruit has a glue-like sap, so when preparing it oil the hands, knives and chopping boards. This prevents the sap from sticking to surfaces. To prepare, peel the skin and cut the fruit into manageable sections. Jack fruit turns brown when exposed to the air; brush cut surfaces with lemon juice to prevent browning. Cut the flesh into pieces. Extract the seeds and discard.

Green jack fruit requires careful seasoning to enhance the natural flavour. Recommended spices to use in jack fruit recipes include cumin, mustard seed, chilli, garlic, onion, tamarind, tomatoes, capsicum, lemon, lime, salad greens and olive oil.

### *Food value*

Jack fruit contains up to 38 per cent carbohydrate, some protein and fat. The fruit is a good source of dietary fibre, carotene, potassium and iron and also contains small quantities of minerals and vitamins. Jack fruit has a higher sugar content than other fruits and yields approximately 335 kJ or 80 kcal per 100 g (English & Lewis, 1991; Stanton, 1986).

### *Use*

Green jack fruit is normally boiled and then fried in a small amount of oil before being served or it can be roasted in hot coals. The flesh can be eaten as a vegetable when half-ripe. It is chopped up and used in stews, curries, soups (especially good with chilli) or in desserts, milk drinks, ice cream and fruit salads.

Ripe jack fruit can be eaten raw as a fruit. It is most delicious when fresh. It can be cut into pieces and added to fruit salad. Shredded fruit can be served with lemon syrup as a dessert.

The seeds, white or brown, can be roasted and eaten.



## Jack Fruit Curry *(serves 3-4)*

### You will need

- 2 cups jack fruit, prepared
- 1/2 cup oil
- 1 medium onion, chopped
- 2 cloves garlic, crushed
- 3/4 teaspoon mustard seed
- 3/4 teaspoon cumin seed, ground
- 1 chilli, finely chopped (*optional*)
- 1 teaspoon salt
- 3/4 cup water or chicken stock
- 2 tablespoons lemon juice

### Method

1. Cut jack fruit into cubes. Heat oil and lightly fry chopped onion, crushed garlic, spices and chilli for a few minutes.
2. Add jack fruit and continue to stir-fry for a few minutes.
3. Season with salt, add stock and lemon juice. Cover pot and simmer till jack fruit is tender.





## Jack Fruit with Crabs *(serves 3-4)*

### You will need

- 3 cups jack fruit, cleaned and chopped
- 3 medium crabs, soft-shelled if possible
- 1/4 cup onion, chopped
- 1/2 tablespoon chopped ginger
- 2 medium ripe tomatoes, sliced
- 1<sup>1/2</sup> cups coconut cream
- Salt

### Method

1. Clean and chop jack fruit into small pieces.
2. Wash and cut crabs into halves or quarters.
3. Put jack fruit into saucepan and add all ingredients except coconut cream.
4. Season coconut cream with salt and add to pot.
5. Cook fairly slowly over medium heat until all the liquid has evaporated and the mixture produces oil.
6. Serve hot





#### 4. Jambolan: *Eugenia brasiliensis*

Jambolan or Java plum, also known as jamun, is the dark purple fruit of a large tree similar in size to a mango tree. The fruit is about 4 cm (1 1/2–1 3/4 in) long and similar to a cherry (English et al., 1996). Each fruit contains a seed surrounded by a thin layer of yellowish pulp. The pulp is very juicy and acidic, and often has an undesirable astringent taste (Rare Fruit Council, 1981).







### *Selection*

When selecting jambolan, look for fruits that are ripe, clean, wholesome and without infestation. They are best picked off the tree. Fruits picked off the ground should not be bruised and must be eaten immediately.

### *Storage*

Wash fruits well and store in a cool place, preferably in small lots, as bigger lots can encourage bruising and fermentation. For longer storage, juice and freeze the juice.

### *Preparation*

If eaten raw, wash well before eating. To make juice, separate the yellow flesh from the seed (thrown away) and reduce to pulp with a blender. Ripe jambolans can also be stewed with water and sugar. The astringent taste can be reduced by soaking prior to cooking.

### *Food value*

Jambolan contains minerals and some dietary fibre. One hundred grams of the raw fruit provides 257 kJ or 61 kcal (English et al., 1996)

### *Use*

Jambolans are usually eaten fresh. They can also be made into jams, juice, preserves and wine.





## Jambolan Preserves

### You will need

- 4 cups jambolan fruit
- 2 tablespoons lemon juice
- 4 cups sugar

### Method

1. Wash and cut pulp from seeds. Do not peel.
2. Put all ingredients in a pot and bring to boil.
3. Boil briskly until setting point. Test.
4. Pour into hot sterilised jars. Cool a little before putting lids on. Store for later use.





## Jambolan Juice

### You will need

- 4 cups firm ripe jambolans
- 3/4 cup water

### Method

1. Wash jambolans and remove stems.
2. Place in saucepan with water and cook until fruit is soft. This will take about 15–20 minutes.
3. Cool slightly and strain with cloth.
4. Pour juice into jug and use as base for juice. This may be diluted or used as it is. Sweeten to taste.





### 5. *Kavika*: *Syzygium malaccense*

*Kavika*, also known as Malay apple, is a small tree with pompom-shaped flowers and glossy, dark-green leaves (Samson, 1986). The tree is beautiful, especially when the bright pink-purple flowers shed their many stamens in a carpet on the ground. The fruit contains a single large seed (Darley, 1993). It is oval, round or pear-shaped, white to pale rose or light red in colour, with a waxy skin and a subtle, astringent, refreshing taste when eaten ripe (English et al., 1996). The main fruiting season is between January and February.





### *Selection*

Fruits should be fully developed as indicated by a change of colour from green to whitish-pink, cream-pink or rose. As the fruit ripens, the seed becomes loose inside. When selecting *kavika*, choose firm, ripe fruits that are clean, wholesome and without bruises.

### *Storage*

In cool weather, fruits will keep in good condition at room temperature for several days. They should be covered to prevent drying. They last longer if kept in cool storage. Stewed half-ripe fruits can be frozen.

### *Preparation*

Wash fruits well before use. Fresh ripe fruit should be handled with care to prevent bruising.

The fruit is generally eaten raw as a snack. Half-ripe fruits can be stewed, with the skin on or peeled. Trim off the blossom end, cut fruit into quarters, and remove seed. Fresh fruit used in fruit salad is best dipped in lemon or orange juice to prevent browning.

### *Food value*

Kavika provides small amounts of Vitamin C and some minerals (English et al., 1996).

### *Use*

Kavika is usually eaten fresh. It can also be used in fresh fruit salad as well as stewed and served as dessert.



## Stewed *Kavika*

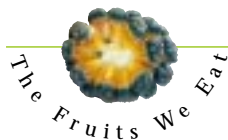
### You will need

- 6–10 *kavika*
- 1 cup water
- 1/2–1 cup sugar
- 1/4 cup lemon juice

### Method

1. Wash, remove rose end, cut in half and remove seed.
2. Place prepared fruit in a pot. Add water, sugar and lemon juice.
3. Bring to boil, lower heat and simmer until fruit is tender. Taste to check whether the syrup is sweet enough. Adjust by adding more sugar or more lemon juice.





## 6. Lychee: *Litchi chinensis*

Lychee or litchi is a popular fruit in China, where it was cultivated thousands of years ago. It is widely grown in Southeast Asia and may have spread from there to the Pacific where it is grown extensively in New Caledonia (Stanton, 1986). It is closely related to other fruits, such as the longan (*Euphoria longana*), which are also indigenous to China.

The fruit resembles a small plum, with rough, green, warty skin (Masefield et al., 1969) covering the edible, white, translucent jelly-like flesh (Stanton, 1986). Maturity is indicated by a change in colour from green to reddish-pink.





During early summer, when lychees mature, the green colour of the skin will change to red, an indication that the fruit is ripe (Samson, 1986). When in season, they are sold in plastic bags or bundles or heaps in markets or along the side of the road.



#### *Selection*

Lychees are best eaten ripe. Ripe fruit should be reddish-pink in colour, with no traces of green remaining. Freshly picked lychees have a sweet and delicate, smooth, cool flavour. The best practical test is to taste the fruit, which should be quite sweet. Choose clean, wholesome fruits that are free of bruises and infestation. The fruits should not have skin tears. If buying in heaps or bags, check each individual fruit whenever possible.



#### *Storage*

Half-ripe fruits will last for two to three days or so at room temperature and up to five days at a cooler temperature. Ripe fruits do not keep well at room temperature, though they will keep for two to three days in cool storage. They may be preserved or dried and processed into a 'nut' (lychee nut). This was a common method of preserving lychees in South East Asia in the 1950s, before canning was introduced.

#### *Preparation*

Wash fruits well before use. To prepare ripe fruit, peel, remove the seed and any excess white pith, and rinse before serving. Serve immediately. Lychee flesh turns brown when exposed to the air. Prevent this happening by dipping it in orange, mandarin or lemon juice. The fruit leaves stubborn stains, so care should be taken not to get it on clothes.

#### *Food value*

Lychees are a good source of Vitamin C, and also provide moderate amounts of dietary fibre and small quantities of minerals and other vitamins (English et al., 1996; Stanton, 1986).





### *Use*

In the Pacific, lychees are normally eaten fresh as a snack. They can also be an ingredient in fruit salads. The flesh can be preserved by bottling.





## Fruit Cocktail

### You will need

- 1 cup seeded lychees
- 1 cup pineapple pieces
- 1/2 cup sliced bananas
- 1 tablespoon sugar
- 1 tablespoon lime or lemon juice

### Method

1. Wash, peel, and cut lychees in uniform size.
2. Combine with other fruits and pour off excess juice.
3. Mix sugar and lime juice well.
4. Pour mixture over fruit and chill for an hour before serving.





## 7. *Nandau*: *Pometia pinnata*

This delicious fruit is known as Pacific litchi or Oceanic lychee. The edible flesh is similar in appearance to that of *Litchi chinensis*. Pacific litchi or Oceanic lychee is found growing on a number of Pacific Islands. No information was found in the literature about its origin. It is called *nandau* in Vanuatu, *dawa* in Fiji, *kao*, *dawa*, *awa*, *tao* or *tava* in Solomon Islands and *tava* in Tonga.

The fruit is generally round and is similar in size to a common guava. The thin skin or shell of the ripe fruit varies in colour from green to dark red-dish-purple and peels off easily from the edible, sweet, translucent white jelly-like flesh that surrounds the seed.

The seeds are eaten in Solomon Islands. They can be roasted or baked (Henderson & Hancock, 1989). They are also preserved by roasting and then drying.

The *nandau* tree is cultivated from seedlings. The mature tree has a very long, slender, but commonly twisted trunk up to 30 m tall, with a dense, untidy crown (Henderson & Hancock, 1989). It grows in the forest and occasionally on the outskirts of villages. There are at least four cultivars of *nandau*, varying mainly in skin colour and fruit size (Henderson & Hancock, 1989).

In most Pacific countries where the fruit is grown, the main season is around November to January, though there may be two seasons on some islands.





### *Selection*

Choose clean, wholesome, ripe *nandau* that are firm but soft and free of infestation. Test ripeness by gently pressing the fruit with the thumb. When buying in heaps or bags, check individual fruit to ensure they are wholesome.

### *Storage*

Like the Chinese lychee, fresh, ripe *nandau* do not keep very well at room temperature, but will keep for two to three days in cool storage. Care must be taken during handling to prevent bruising.

Pacific Islanders do not generally preserve the flesh of the fruit. The seeds can be dried and stored.

### *Preparation*

Fresh fruit should be washed well before use. Remove the skin by gripping the fruit around its circumference and twisting. Two shell-like halves will come away from the edible, fleshy part. Remove seed, rub off the white pith and rinse thoroughly. Serve immediately.

*Nandau* flesh turns brown (oxidises) when exposed to air. Keep under water before use or dip in orange or lemon juice to slow down or prevent browning.

### *Food value*

Like most fruits, *nandau* is a good source of Vitamin C, some dietary fibre and small amounts of vitamins and minerals.

*Nandau* or Pacific litchi is always eaten fresh as a snack. More recent use is as an ingredient in tropical fruit salads. The flesh can also be preserved by bottling or by stewing in light syrup and then freezing.

### *Non-food uses*

The tree has medicinal and construction uses. In Papua New Guinea, the masticated bark is applied to burns. *Nandau* has moderately hard wood and is an important source of timber for construction, interior finishing, boat-framing and general purposes in most Pacific Islands. It is a good fuel wood.



## 8. Passionfruit: *Passiflora edulis*

This delicious, sweet-tasting, aromatic fruit grew wild and was once even referred to as a weed. It is said to have originated from South America (Stanton, 1986) and spread to Australia, New Zealand and the Pacific Islands. Passionfruit was given its name by a Spanish priest who noted that the flower parts numerically matched the various sufferings of Christ (Darley, 1993).

A number of varieties of passionfruit now grow in Asia, Australia, New Zealand and the Pacific. It was considered a commercially viable fruit in many parts of the Pacific during the 1970s and some varieties were specially introduced for export. Processing plants were set up in the islands to process juice for export and for local consumption. Today some are still producing, but mainly for local consumption. Limited overseas markets have hindered the commercial production of this fruit (Carlos & Ooi, 1987).

Passionfruit is also known as bell apple. It grows on a climbing vine. Usually the fruit has a hard, green to brown skin that turns yellow or darkens to deep purple when mature. There is also a variety with a soft, furry yellow skin and another that has hard skin and looks like an egg. The skin may also be wrinkly in some varieties (Samson, 1986).

Inside the shell is a yellowish-orange pulp that can be quite sweet or tart, mixed with black seeds. The whole mixture of pulp and seeds is eaten together. It has a very rich and distinctive aroma.





### *Selection*

Choose firm fruits with a yellow or purplish tinge and ripen under controlled conditions when possible. If fruit has been ripened, the skin may be starting to wrinkle. In these cases, select fruits that are still yellow or purple and have not turned dark brown. The fruit should be clean and free from infestation.

### *Storage*

Mature passionfruit ripens within two to three days after picking. Once ripe, the skin becomes wrinkled and soft. Its skin can easily be damaged, so fruits should be carefully laid out on racks or shelves. Cold storage at 7°C can lengthen its shelf life up to a month (Darley, 1993). Passionfruit pulp or concentrate can be frozen for longer storage. It freezes well, particularly if sugar is added, 50 per cent by volume.

### *Preparation*

Wash fruits, cut in half, scoop out the pulp and use as desired. The fruit can be eaten raw or a concentrate can be made from the pulp. For drinks, dilute one part of pulp with three parts of water and add sugar to taste.

Adding fruit directly to milk may result in curdling because it is very acidic.

### *Food value*

Passionfruit has a high content of dietary fibre due to the presence of the seeds. Normally it has more fibre than other common fruits such as oranges, limes and mandarins. Fresh fruits provide a small amount of Vitamin C and niacin, with approximately 434 kJ or 105 kcal of energy per 100 g of passionfruit flesh (Stanton, 1986)

### *Use*

Passionfruit eaten raw makes a delicious snack. The pulp can be added to fruit salads or made into drinks and used as flavouring in desserts. The concentrate makes delicious dessert toppings. Passionfruit can also be used for garnishes and spreads (Inglett & Charalambous, 1979).



## Passionfruit Syrup



### Method

1. Add sugar to water and heat to boiling point.
2. Add pulp and bring to boil.
3. Pour into sterilised jars and seal at once.  
Syrup keeps well up to six months.
4. Use for drinks, cake icing, frozen desserts and as topping for desserts.

### You will need

- 2 cups water
- 3 cups sugar
- 1<sup>1/2</sup> cups fresh passionfruit pulp





## Passionfruit Sauce

### You will need

- 1/2 cup sugar
- 1 1/2 tablespoons cornstarch
- 1/4 teaspoon salt
- Pinch ground ginger
- 1/2 cup boiling water
- 2 tablespoons margarine
- 3/4 cup passionfruit juice

### Method

1. Mix together sugar, cornstarch, salt and ginger.
2. Add water gradually.
3. Cook over medium heat until sauce is thickened, stirring all the time.
4. Add margarine and fruit juice. Bring to boil.
5. Remove from heat.
6. Serve with cakes or fresh bananas.







### 9. Star fruit (carambola): *Averrhoa carambola*

This unusual-looking fruit is said to have originated from Malaysia and Southeast Asia (Darley, 1993; Stanton, 1986). In the early days they were found growing in Papua New Guinea, Tahiti and New Caledonia (Landauer & Brazil, 1990). They are widely grown in many parts of the Pacific, especially Fiji Islands, the Cook Islands and New Caledonia. There are sweet and sour varieties. The sour varieties contain a fair amount of oxalic acid.

The plant produces several crops a year (Darley, 1993). The fruit has five longitudinal ridges, which make it an attractive fruit when cut, with the cross-section resembling a starfish. It is sometimes called the five-cornered pear.





### *Selection*

The fruit does not ripen after harvest. It can sometimes be difficult to check when the fruit is mature because of the different varieties and their colours. Some may turn lighter green, yellow or off-white when mature (Darley, 1993). The sugar content rises with maturity. Choose ripe star fruit with a sweet smell and free of bruises. They are best left to ripen on the tree before picking. Those picked off the ground should be free from bruises and infestation.

### *Storage*

Star fruit will keep longer if they are not damaged. They are best kept under cool storage, where they can last for two to four days. Fruits are best arranged in single rows on a rack to prevent bruising. Pureed, they can be frozen for longer storage. Stewed carambola can also be frozen.

### *Preparation*

Wash fruit well before use. Trim the corners and cut into wedges or slice to form stars. For the sour variety, peel off a 2 mm layer from the ridges to remove the oxalic acid. For making drinks, wash, cut and puree fruit using a blender. Sliced or cubed star fruit can also be used as an ingredient in fish and other meat dishes.

### *Food value*

Star fruit has some Vitamin C, dietary fibre and small amounts of minerals and vitamins. One hundred grams of star fruit provides about 149 kJ or 36kcal of energy and 35 mg of Vitamin C (Dignan et al., 1994).

### *Use*

The fruit is best eaten raw as a snack. It can also be used for juice, jam, garnish, in fruit salads, vegetable salads, drinks, main courses, pickles and desserts. In some parts of Asia, star fruit are sliced, sprinkled with sugar and dried in the sun. They can be used in recipes where apple is required. The green fruit is used as a vegetable and for pickling.



## Star Fruit Juice

### You will need

- 2 cups sliced star fruit

### Method

1. Wash fruit carefully and cut into small pieces.
2. Using a blender, blend the fruit into a thick puree. If blender is not available, chop the fruit into small pieces and put through a metal sieve.
4. Strain the juice to remove fibre.
5. Serve diluted: 1 cup juice to 2 cups water.





## Star Fruit Pickles

### You will need

- 2 cups star fruit slices
- 3/4 cup sugar
- 1/4 cup vinegar
- 1 inch cinnamon stick
- 1/4 teaspoon whole cloves

### Method

1. Wash and slice star fruit crosswise and place in bowl.
2. Make a syrup of sugar, vinegar, and spices. Bring to boil.
3. Pour over star fruit and leave to stand overnight.
4. Next day, drain syrup into a small pot and bring to boil again.
5. Place slices of star fruit in hot sterilised jars and pour boiling syrup to cover. Seal and store in cool place.





## 10. Tamarind: *Tamarindus indica*

Tamarind trees can be found growing in many parts of the Pacific. They normally grow to the same height as a large mango tree.

Tamarind is a native of Africa and Asia (Stanton, 1986). It was probably brought into the Pacific by early Chinese traders and settlers. It belongs to the Leguminosae family. The tree bears large pods that ripen in early summer. A pod may weigh 10–15 g, about 40 per cent of which is pulp (Samson, 1986)

The mature pods contains several large seeds surrounded by date-like pulp and protected by a brown, brittle shell (Rare Fruit Council, 1981). The fruit contains 9 per cent citric acid, 4 per cent tartaric acid, and over 20 per cent various sugars, making it one of the sweetest, most acidic of all fruits (Darley, 1993). The tart, acidic pulp is the part used in cooking. Fresh tamarind pulp may be sold in markets. Some tamarind is imported.



### *Selection*

Generally, tamarind flesh is available locally in 'balls', consisting of fibres and some seeds. For these, select the ones with a higher proportion of pulp than seeds and fibres, and free of twigs. If fresh pods are available, choose those that are fuller and heavier.

### *Storage*

Because of its high acidity, tamarind can keep for a reasonable length of time without cool storage. Store in a clean covered container. It will last even longer if kept in cool storage.

### *Preparation*

To remove tamarind from the pod, carefully wipe the pod with a damp clean cloth, taking care not to break the shell into small pieces. Remove the outer shell, and form the contents of several pods into a ball. The seeds can be removed before storage if required. Keep in a container. When required, knead in water, and use the liquid for cooking.

### *Food value*

The fruit is a very good source of dietary fibre, potassium, iron, calcium and thiamine (Vitamin B1). One hundred grams of tamarind flesh provides 8.5 g of dietary fibre (Dignan et al., 1994).

### *Use*

Tamarind is popular with children. It is eaten fresh or stewed with sugar.

Ripe tamarind is used to season curries, meat, fish or rice dishes (Stanton, 1986). Indians make delicious chutneys from tamarinds. They can also be used to make very refreshing drinks. In Fiji, the seeds (and pulp) are dried and used as lollies. Tamarind is a major ingredient of Worcestershire sauce.



## Preserved Tamarind

### You will need

- Ripe fresh tamarind
- Sugar

### Method

1. Remove the brown shells from the tamarind.
2. Pack the pulp and seeds in a firm layer in a sterilised jar, alternating with a thin layer of sugar, until the jar is filled.
3. Seal and store in a cool place for at least three months before using.



## Tamarind Syrup

### You will need

- 1 cup tamarind pulp
- 3 cups water
- 2<sup>1/2</sup> cups sugar

### Method

1. Soak tamarind pulp in water overnight.
2. Add sugar and boil 15–20 minutes.
3. Cool and strain through a coarse sieve, pressing pulp through.
4. Heat the sieved syrup to boiling point.
5. Pour into sterilised jars and seal. Use in curry, chutneys or drinks.





### 11. **Tarawau:** *Dracontomelom vitiense*

This unique fruit is widely available in Fiji Islands and Vanuatu and has been reported growing in Samoa (English et al., 1996). It is known as *nakatambol* in Vanuatu and *faorao* in Rotuma. The fruit probably originated from tropical Asia, where it is known as dragon plum, but some people believe that it may be native to Vanuatu. The tree is very large, with big, buttress roots, usually growing not far from the coast, and bears bunches of small, round fruit containing a single hard seed.

#### *Storage*

Half-ripe fruits will keep for three to four days at normal temperature. Fully ripe ones may keep for a day or two. Cold storage will lengthen the shelf life.

#### *Preparation*

Wash well before use.

#### *Food value*

*Tarawau* is an excellent source of potassium, calcium and iron. It also contains some Vitamin C and small amounts of other vitamins (Dignan et al., 1994).

#### *Use*

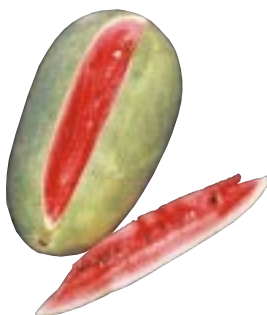
The use of this fruit is limited. It is mainly eaten raw as a snack food.

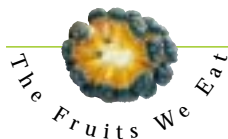


## 12. Watermelon: *Citrullus lanatus*

The origin of watermelon is believed to be in the Middle East, although some maintain that it is native to India and tropical Africa (Stanton, 1986). However, regardless of where it came from, watermelon is the favourite fruit during the summer months in many parts of the Pacific. During the harvesting season, watermelon can be found around every corner of most markets and even along the roadsides of small towns.

The melon can range in weight from 2 to 25 kg or even more (Stanton, 1986). Certain varieties are sweeter than others. Sugarloaf varieties are normally considered sweet, but they are smaller in size than the common variety. The flesh may be white, pale pink or bright red. Those with white flesh are not as sweet as the pink- to reddish-fleshed varieties.





### *Selection*

Select the appropriate size for the family if a whole fruit is required. In general, it is best to buy the largest fruit, which are more likely to be fully developed and mature, with unblemished shining skin. Ripe fruit is usually judged by the light thudding sound it makes when tapped or knocked with the knuckles. If unsure, it may be best to buy half or quarter sections whose colour, thickness of skin and appearance of flesh can be used to help in the selection. Generally a light to dark reddish-pink colour, thicker skin and 'porous' flesh are signs of a ripe, sweet melon.

### *Storage*

Ripe, whole fruit can keep for one to three weeks at normal room temperature. They keep better in a cool place. Cut melons do not keep well except in cool storage. Cut pieces should be covered with plastic to prevent drying and then kept in cool storage (Parkinson, 1989). Cut melon in cool storage will last three to five days. For longer storage, juice and freeze.

### *Preparation*

Wash or wipe the whole fruit with a damp, clean cloth. Cut into desired size if to be eaten fresh. The flesh can be cut into cubes or into balls. For drinks, scoop out the flesh, remove seeds and blend in a blender. To make preserves, cut melon skin into cubes or strips and use.

### *Food value*

Watermelon contains mostly water and therefore does not have as much energy as other fruits. It has the highest amount of water of all common fruits in the Pacific. It is very refreshing, especially during hot weather. Other varieties of melons, not directly related to watermelon, that are available in the Pacific include cantaloupe and honeydew or rock melon (O'Brien & O'Dea, 1987).

### *Use*

Melon is best sliced and eaten fresh as a snack, for breakfast, and as dessert fruit. It makes a good addition to fruit salads. Its flesh can be made into fruit juice and, when mixed with freshly grated coconut, into a delicious and refreshing drink called *otai* in Tonga and Fiji Islands. The seeds are edible, contain an oil, and can be dried and eaten as a snack. Melon skin can be candied and preserved.



## Water-melon *Otai* (Fruit drink with coconut)



### Method

1. Into a large container or jug, put fruit pulp and sugar.
2. Add coconut water, grated coconut and citrus juice if desired. Stir well.
3. Add more sugar if desired. Serve chilled if possible.

### You will need

- Fruit pulp – watermelon
- 2 tablespoons sugar (to taste)
- 1 cup coconut water
- 2 tablespoons freshly grated coconut
- 2–4 tablespoons citrus juice, (*optional*)

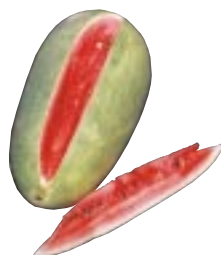
#### *Variations for fruit pulp*

Soursop — one or two soursops depending on the size

Mango — 4–5 ripe or half-ripe mangoes, mashed or grated

Wi — 2 mature fruits, grated

Pineapple — 1 medium, crushed





### 13. *Wi: Spondias dulcis*

*Wi*, *vi*, *vi kavakava* and *naus* are some of the local names given to this juicy and tasty fruit. It is also known as the Polynesian plum and wild apple (Henderson & Hancock, 1989) and belongs to the same family as the mango (Anacardiaceae) (Massal & Barrau, 1956). It is thought to have been cultivated in Asia and then spread to the Pacific.

The Polynesian plum grows mostly in Melanesia and Polynesia. Although there are six known varieties and the fruit trees are now widely grown, most of the recent information has been collected only from Vanuatu, where two of the known varieties have been identified as the most common (Barrau, 1955).

Polynesian plum or wild apple trees may be found growing around villages, in food gardens or in the bush. They are described by Henderson and Hancock (1989) as first-storey fruit trees with large, thick buttresses up to 3 m high, having long, clear trunks of up to 20 m. The tree has compound, light-green leaves and small greenish-yellow flowers. It can be planted from seeds, cuttings or grafted. The fruit, which is round or oval, is between 4 and 10.5 cm (1.5–4 in) long, depending on whether it is a wild or domesticated variety.



The fruit is green at first and when mature turns yellow or yellowish-brown. It has an unusual prickly seed that is surrounded by a mass of string-like bunches of fibres. This can be very hard, especially when the fruit is ripe. The seed is contained inside the endocarp (which is the skin covering the seed), where the string of fibres grows out towards the outer layer (skin) of the fruit.

If the trees are grown for local fruit production they are usually well looked after, and may be trimmed regularly to increase the yield. Trimming also helps strengthen the tree to withstand damage from hurricanes or cyclones.



### *Selection*

*Wi* are best when they are just under-ripe. The skin may have a lighter green colour or just a tinge of yellow. The fruit should be free from bruises and insect infestation. Its skin should be clean and not broken. Over-ripe *wi* is all yellow and soft.

### *Storage*

Under-ripe fruit can last for up to three days under normal conditions. They will last for up to five to six days in cold storage. Ripe fruit does not keep and must be eaten immediately.

### *Preparation*

Wash thoroughly before use. The fruit is usually eaten peeled. Peel with a sharp knife or a peeler. Cut out wedges of flesh out from the seed with a sharp knife, and serve. For drinks, cut flesh into cubes and blend using a blender. For *otai* fruit drink and for dessert, grate the peeled fruit. Wedges can be preserved by bottling.

### *Food value*

Polynesian plum is a good source of dietary fibre and Vitamin C. It also contains small amounts of minerals and vitamins, very little energy and more than 80 per cent water (Dignan et al., 1994).

### *Use*

The fruit of the Polynesian plum can be eaten fresh (raw), or roasted with the skin, or grilled. The fruit makes a good snack. It can also be used fresh to make drinks, or grated and made into a refreshing dessert by mixing with freshly grated coconut. It also makes good jelly. Stewed, it makes a good cooked breakfast fruit.

### *Other non-food uses*

The other parts of the tree are also very useful. The trunks are used as building materials and for making the wooden joints in traditional island canoes. They are favoured for their hardness.



## *Otai Wi* (dessert)

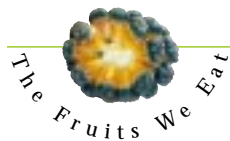
### **You will need**

- 2 mature *wi* fruit
- Sugar to taste
- 1/2 cup freshly grated coconut
- 1 cup water
- Juice of 1/2 lemon (optional)

### **Method**

1. Wash and peel fruit and grate into a bowl.
2. Add sugar and grated coconut. Mix thoroughly.
3. Add water and blend well. Taste. If needed, add lemon juice to flavour.
4. Serve cold.





## Wi Tart

### You will need

- 3 cups *wi* flesh
- 1/2 cup cold water
- 2 lots of 1/4 cup sugar
- 1/2 cup hot water
- 1 tablespoon gelatine
- 1 dessertspoon lemon juice
- 150 ml coconut cream made into thick custard with custard powder
- 1 baked pie-crust

### Method

1. Wash and peel *wi* and chop flesh off the seed. Stew in 1/2 cup of water and 1/4 cup sugar. Cool and sieve. Put aside.
2. Put hot water in a dish, sprinkle on gelatine and mix.
3. Add pureed *wi*, lemon juice and the remaining sugar.
4. Fold in custard and spoon into pie-crust.
5. Chill until firm. Serve.







## V. NUTRIENT COMPOSITION

The most important nutrient contributions fruits make to our diet are Vitamin C, carotene, dietary fibre and some minerals (McGee, 1984; Passmore & Eastwood, 1986; Samson, 1986; Jen, 1989). With the exception of avocados, fruits contain little or no protein or fat. Ripe fruits contain the simple sugars fructose and glucose, but (with the exception of jack fruit) no starch (Passmore & Eastwood, 1986). They are best eaten fresh and raw for maximum nutritional benefit. As a source of vitamins, minerals and dietary fibre, fruits are indispensable in the diet (Samson, 1986). Nutritionists advise a daily intake of at least 100 g of fruit and as much variety as the season permits (McGee, 1984). The Australian food group guide recommends four serves of fruits and vegetables a day (Wahlqvist, 1997).

### **Comparison of nutritional values**

As a group, fruits are good sources of the same types of nutrients. But the amount of each nutrient present differs considerably, depending on the fruit variety, maturity, cultural practices, climate and location of the growth (Jen, 1989). Appendix 2 presents a comparison of the nutrient content of the fruits discussed in this booklet, with each figure showing the amount of a specific nutrient contained in 100 g of fruit. This presentation enables the reader to compare, for example, the Vitamin C content or amount of dietary fibre present in different fruits. Table 2 presents the average nutrient values of fruit as a group, as well as the range in values. It shows that at least two thirds of the weight of most fruits is water and highlights the wide range in the amount of nutrients present in the varieties of fruit available in the Pacific.



**Table 2: Average nutrient composition of some common fruits in the Pacific**

<b>Nutrient (weight)</b>	<b>Average/100 g raw</b>	<b>Range/100 g raw</b>
Water (g)	65.0	36–93
Energy (kJ/kcal)	486/116	4–913/10–221
Protein (g)	2.7	0.4–4.9
Fat (g)	11.5	0.1–22
Carbohydrate (g)	25.5	0.1–51
Dietary fibre (g)	5.2	0.3–10.4
Sodium (mg)	12.5	1–24
Potassium (mg)	426.5	89–764
Calcium (mg)	126.7	0.4–253
Iron (mg)	0.85	0.2–11.5
Zinc (mg)	0.45	0.1–0.8
Vitamin A (ug)	136.0	12–260
Thiamine (mg)	0.175	0.01–0.34
Riboflavin(mg)	0.08	0.2–0.14
Niacin (mg)	1.5	0.1–2.0
Vitamin C (mg)	121.0	2–240



## Processing and nutrient values

The length of home storage time before consumption and the method of preparation have a significant bearing on nutrient retention (Jen, 1989). Poor storage of fruits at home or commercially and careless preparation may result in loss of Vitamin C. Leaving fruits in the sun causes Vitamin C loss. The vitamin is lost if the plant cells are damaged by careless cutting; it dissolves in water (McGee, 1984). Prolonged heating or cooking, as in making jam or chutney, also destroys Vitamin C and the rate of loss can be increased by the use of utensils containing copper or iron.

Commercial processing also has some destructive effects on nutrient values (Jen, 1989). Thermal processing alters the colour, flavour, texture and nutritive values of fresh fruits. The chemical and biochemical changes that occur during processing may also cause undesirable smells and discoloration of fruits, as seen in mashed bananas.

Generally, most well known brands of processed fruits have tight ingredient specifications, known as food product standards. Thus, most frozen and canned fruits may contain as much nutrient as fresh raw products. Others, such as fruit juices, may be fortified with vitamins — in fact, ascorbic acid (Vitamin C) is often higher in processed foods than in non-processed ones (Jen, 1989).

The processing of fruit into fruit juice reduces the amount of dietary fibre present by breaking down the fruit fibres and making them more soluble in water. Eating whole fruit, for example an orange or a mandarin, is better than drinking orange juice, especially if a person needs to increase the fibre content of the diet. Whole fruits also contain soluble fibre that can protect against high cholesterol levels and high blood pressure.

The bio-availability of the goodness in whole fruits is higher when the whole fruit is eaten than when it is consumed as juice. In addition, most commercial fruit juices have to be pasteurised to allow them to keep longer, a process that destroys much of the Vitamin C present. To compensate for this, ascorbic acid is added to make up for the loss. The added ascorbic acid is a synthetic substance and does not appear to have the same qualities and



values as natural Vitamin C. Therefore, its bio-availability for the body appears not to be the same as that found in the whole fruit (Jen, 1989).

Most tropical fruits are peeled before being eaten. Some fruits, such as guavas, *tarawau* and *wi* (Polynesian plum), can be eaten with the skin, but the fruit should be thoroughly washed first. With new technology and new uses, the skins or peels of some fruit, such as lemon and orange, are processed and preserved to provide flavour and aroma in cooking.



## VI.FUTURE FOR TROPICAL FRUITS

### **Production and supply for local consumption**

Fruit trees are traditionally grown in home gardens, a common sustainable food production system in Pacific countries (Christantly, 1990). The products from home gardens were primarily for household consumption (Landauer & Brazil, 1990). Today, products from the garden can have multiple uses, contributing significantly to both the nutritional and income needs of the households (Christantly, 1990).

Unfortunately, with changes brought about by economic development, this tradition appears to have lost its importance in the provision of family food. The promotion of the family or home food garden is therefore of utmost importance in the Pacific to ensure that low-income families and households are food-secure. In addition, its economic benefits to families have never been properly assessed (Varsey, 1990). There is a need for on-going home garden programmes to be revitalised and re-emphasised. They should include improved subsistence farming methods that combine proven and cost-effective traditional and modern practices (Sommers, 1990).

There is also a need to recognise that Pacific Island culture (like most others) is changing. A consequence of this change is that the younger generations appear uninterested in gardening, household food security or farming. The perceived notion that 'working the land is menial and to be avoided at all cost' is prevalent and has contributed to the problem (Manarangi, 1998). This perception must be changed if the younger generations are to take an interest in the challenges of farming. Concerted efforts must be made to refocus and re-orient school and community-based programmes for young people so that they are interesting and innovative. Promotion, consultation, education and participation of young people in agricultural programmes and training are crucial. Understanding the importance of the addition of fruit to the diet is a key factor since it is an indispensable source of health-providing nutrients, vitamins, minerals and fibre (Samson, 1986). If the current declining consumption trend is to be reversed, production of



fruits for the local market should be encouraged and increased to ensure an adequate supply for the population.

### **Commercial production**

The potential value of fruits to the economy of the region has yet to be fully realised. Those countries that have been exporting fruits to neighbouring countries such as New Zealand and Australia have been doing so in an 'on-and-off' fashion. In many parts of Polynesia, such as the Cook Islands, oranges, pineapple and passionfruit were major export crops in the 1960s to 1980s. Watermelon was a major export crop from Tonga to New Zealand for a number of years.

Despite the commercial potential and the many attempts made in the past (Carlos & Ooi, 1987), Pacific countries are still struggling with fruit exports and have not been able to establish themselves as reliable tropical fruit exporters. The reasons for this are many.

Commercial fruit farming development in the smaller Pacific Island countries is constrained by their isolation, a limited and restricted environment, lack of capital, natural disasters, the effect of other agricultural activities and the conflict between export-oriented policy and the need to strengthen smallholder farms for the local markets (Sommers, 1990).

The Regional Tropical Fruit Meeting held in Noumea, New Caledonia, on 20–24 July 1998 highlighted some of the constraints to the production of fruit and expansion of the fruit industry in the Pacific Islands. These include:

- The patterns of labour, social organisation and land tenure, which are all based on subsistence agriculture;
- The nature of the producers, who are mostly small farmers scattered over an island and cannot organise themselves into a larger group for the purpose of improving their bargaining power for better prices;
- Lack of permanent and adequately trained staff and personnel to support farmers;



- Low motivation and interest in farmers;
- Increase in imports of temperate-climate fruits;
- Poor transportation system — most farmers are not connected by good roads or shipping services; transport operators are not equipped to carry perishable products;
- Inadequate business and marketing skills;
- Inadequate knowledge about production systems, new or improved varieties, and post-harvest handling; and
- Outdated infrastructure, including lack of food standards and quarantine regulations to meet export market requirements (Anon, 1998; Bala, 1998; Carlos & Ooi, 1987; Macfarlane, 1998; Manarangi, 1998; Williams, 1998).

The challenge facing the fruit industry for Pacific Island countries is to address the constraints identified above. Some specific issues for fresh fruit exports identified by Macfarlane (1998) include:

- The selection of appropriate cultivars and varieties to suit export markets (varieties to target consumer preference, those with good shelf life);
- Continuity of supply through routine production of quality fruit at the correct stage of ripeness and in suitable amounts;
- More research into new cultivars that are disease-resistant or bear fruit more than twice per year, and into post-harvest handling to lengthen shelf life;
- Need to minimise artificial inputs, particularly pesticides;
- Grading of fruits to meet export quality standards and consumer demands;
- Market access (development and application of quarantine treatments to meet import requirements);
- Development and use of correct packaging materials;
- Correct handling procedures to minimise damage after harvest;
- Correct storage conditions to optimise storage and shelf life;
- Correct ripening procedures.

Not all fruits grown and harvested can be exported fresh or eaten domestically. These fruits could be processed into a wide range of products that could offer alternatives for the local market or, if of suitable quality and price, be exported. Macfarlane (1998) identified issues for fruit processing, including:



- The identification of products desired by target consumers;
- The development of processes that meet market requirements;
- Supply of quality fruits (poor-quality fruits will give poor-quality products);
- Supply of clean, safe water for use in processing;
- Supply of equipment that operates efficiently and suits conditions in Pacific Island countries;
- Suitable packaging materials;
- Meeting of important health standards;
- Use of processing methods that meet international standards, including the new Hazard Analysis Critical Control Point system;
- Correct labelling;
- Continuous production to meet demand; and
- Reduced operating costs.

The above require considerable financial input — a commodity Island countries lack. However, unless countries and individuals can address the issues identified above, the potential of tropical fruits for their economy will not be fully realised.

### **The Pacific taste**

There is no substitute for the taste of fresh tropical fruits picked off the tree at the right stage of maturity (Samson, 1986). This natural quality of Pacific fruits needs to be maintained. Maintenance of most of the original fruit smell and flavour will ensure greater health benefits and provide a good advertisement for Pacific fruits.

Commercial food industries strive for high yield, improved shelf life and the ability of fruits to resist pests and diseases. Unfortunately, commercial food industry's priorities and requirements for the commercial markets make fruits sold in overseas supermarkets lose much of their natural flavour. Harvesting of fruits at the 'right stage of ripeness' for export, and artificial ripening, often result in loss of natural quality, flavour and sweetness.

Research into new cultivars should also include 'natural taste', as well as other qualities currently considered.





## **Atoll research**

Many of the atolls in the Pacific have problems maintaining an adequate supply of good-quality fruits because of their geographical isolation, harsh environment and poor soil and water. This makes it more difficult for atoll dwellers to access fresh fruits on a regular basis. As a result, certain vitamin deficiencies are still prevalent in these areas.

Regional and international organisations have worked hard to improve certain varieties of tree crops and introduce new species. Assessment of fruit trees that would be viable for growth in the atoll environment has been carried out to identify new strategies for development.

A review of fruit trees in a number of atolls in the Pacific has recognised the challenge faced by the farming sector in growing citrus trees in atolls. The review recommended that further studies be carried out to look into suitable varieties, rootstock and management practices (Carlos & Ooi, 1987).



## VII. REFERENCES

Anon. (1998). Diversified tropical fruit trees in Tonga. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July 1998.

Australian Allied Land Forces. (1943). *Friendly Fruits and Vegetables*. (1943). Arbuckle Waddell, Melbourne.

Badcock, J. (ed.). (1983). *Nutrition Manual for Papua New Guinea*. Department of Health, Papua New Guinea.

Badcock, J., F. Bach, R. Taylor, M. Lund & T. Fred. (1993). *Vanuatu Dietary Study 1985*. SPC Technical Paper No. 204. South Pacific Commission, Noumea, New Caledonia.

Baiteke, C. (1990). The cultural approach to atoll agriculture. Paper prepared for the International Conference on Developing an Agriculture Research Programme for the Atolls, 19–23 November 1990, Pacific Harbour Hotel, Fiji.

Bala, A. (1998). Profile of Papua New Guinea fruits and nuts. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July 1998.

Barrau, J. (1955). *Subsistence Agriculture in Melanesia*. South Pacific Commission, Noumea.

Berry, R. (1979). Subtropical fruits of the Southern United States. In: Inglett, G.E. & G. Charalambous (eds.). *Tropical Foods: Chemistry and Nutrition*. Academic Press Inc., London. Vol. 1: 95–110.

Burdon, J. (1998). Postharvest handling of tropical fruit. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July.

Cambie, R.C. & J. Ash. (1994). *Fijian Medicinal Plants*. CSIRO, Australia.

Carlos, J.T. & S.C. Ooi (eds.). (1987). *Tropical Fruit Production in the South Pacific*. Proceedings of a Regional Technical Meeting, Cook Islands. ADP/IRETA.



Cavaletto, C.G. (1979). Sensory quality of tropical fruits. In: Inglett, G.E. & G. Charalambous (eds.). *Tropical Foods: Chemistry and Nutrition*. Academic Press Inc., London. Vol. 1: 25–32.

Charley, H. (1982). *Food Science*. John Wiley & Sons, New York.

Christantly, L. (1990). Home gardens in tropical Asia, with special reference to Indonesia. In: Landauer, K. & M. Brazil (eds.). *Tropical Home Gardens*. United Nations University Press, Tokyo: 9–20.

Coyne, T. (1984). *The Effect of Urbanisation and Western Diet on the Health of Pacific Island Populations*. Technical Paper No.186. South Pacific Commission, Noumea, New Caledonia.

Darley, J.J. (1993). *Know and Enjoy Tropical Fruits: Tropical Fruits and Nuts: a Cornucopia*. P & S Publishing, Thuringowa, Queensland.

Dignan, C.A., B.A. Burlingame, J.M. Arthur, R.J. Quigley & G.C. Milligan. (1994). *The Pacific Islands Food Composition Tables*. South Pacific Commission, Noumea, New Caledonia; New Zealand Institute of Crop and Food Research, Ltd; and International Network of Food Data Systems, Palmerston North, New Zealand.

Egan, H., R.S. Kirk & R. Sawyer. (1981). *Pearson's Chemical Analysis of Foods*. Eighth Edition. Longman Scientific and Technical, Harlow, Essex, United Kingdom.

English, R.M., W. Aalbersberg & P. Scheelings. (1996). *Pacific Island Foods. Description and Nutrient Composition of 78 Local Foods*. Institute of Applied Sciences, University of the South Pacific and Australian Centre for International Agricultural Research, Australian Government Analytical Laboratories. Technical Report 96/02.

English, R.M. & J. Lewis. (1991). *Nutritional Values of Australian Foods*. Department of Community Services and Health, Australian Government Publishing Service, Canberra.



Fieldhouse, P. (1986). *Food and Nutrition, Customs and Culture*. Chapman and Hall, London.

Food and Nutrition Research Institute. *Food Composition Tables Recommended for Use in the Philippines*. (1990). Sixth revision. Food and Nutrition Research Institute, Department of Science and Technology, Philippines.

*Food Processing by Rural Families*. Proceedings of the Seminar on Food Processing by Rural Families, 20–22 May 1985, Los Banos, Laguna, Philippines. Philippine Council for Agriculture and Resources Research and Development (PCARRD), Los Banos, Laguna, Philippines.

Henderson, C.P. & I.R. Hancock. (1989). *A Guide to the Useful Plants of Solomon Islands*. Research Department, Ministry of Agriculture and Lands, Honiara, Solomon Islands.

Hiyane, J.T. (1971). *Pandanus in the Marshall Islands*. Agriculture Extension Bulletin No 10. Trust Territory of the Pacific Islands.

Inglett, G.E. & G. Charalambous (eds.). (1979). *Tropical Foods: Chemistry and Nutrition*. Academic Press Inc., London.

Jardin, C. (1974). *Kulu, Kuru, Uru. Lexicon of Names of Food Plants in the South Pacific*. Information Document No. 35. South Pacific Commission, Noumea, New Caledonia.

Jen, J.J. (ed.). (1989). *Quality Factors of Fruits and Vegetables*. American Chemical Society, Washington D.C.

Kirschmann, G.J. (1996). *Nutrition Almanac*. McGraw-Hill, New York.

Lambert, M. (ed.) (1968). *Banana Production in the South Pacific*. Handbook No. 5. South Pacific Commission, Noumea, New Caledonia.

Lambert, M. (ed.) (1970). *Coconut Production in the South Pacific*. Handbook No. 6. South Pacific Commission, Noumea, New Caledonia.



Landauer, K. & M. Brazil (eds.). (1990). *Tropical Home Gardens*. United Nations University Press, Tokyo.

Liant, R. (1998). General description of tropical fruit sector in French Polynesia. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July 1998.

Macfarlane, B. (1998). New Zealand horticulture research relevant to Pacific Island countries. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July 1998.

Malolo, M., R. Bishop, E. Telmetang, J. Bale, B. Chiokai, E. Kalosang, R. Louch & M. Emesiochl. (1995). *Palauan Foods Naturally the Best*. South Pacific Commission, Noumea, New Caledonia.

Manarangi, A. (1998). Tropical fruit country profile of the Cook Islands. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia, 20–24 July 1998.

Masefield, G.B., M. Wallis, S.G. Harrison & B.E. Nicholson. (1969). *The Oxford Book of Food Plants*. Oxford University Press, Great Britain.

Merlin, M., A. Capelle, A. Keene, & T. Juvik. (1994). *Keinikkalm Melan Aelon Kein. Plants of the Marshall Islands*. MacArthur Foundation, Chicago, USA.

Massal, E. & J. Barrau, (1956). *Food Plants of the South Sea Islands*. Technical Paper No 94. South Pacific Commission, Noumea, New Caledonia.

McGee, H. (1984). *On Food and Cooking: The Science and Lore of the Kitchen*. Unwin Hyman Ltd., New York.

Parkinson, S. (1989) *Cooking the South Pacific Way*. Tourism Council of the South Pacific (TCSP), Fiji Times, Fiji.

Parkinson, S., J. Tunidau & M. Chand. (1992). *A Nutrition Handbook for the South Pacific Islands*. Fiji National Food and Nutrition Committee, Suva, Fiji.



Passmore, R. & M.A. Eastwood. (1986). *Human Nutrition and Dietetics*. Churchill Livingstone, Edinburgh.

Peace Corps. (1977). *Niu Ideas*. US Government Printing Office, Washington.

Pieris, W.V.D. (1955). *Wealth from the Coconut*. Ure Smith Pty. Ltd., Sydney.

Potter, N.N. & J.H. Hotchkiss. (1998). *Food Science*. Aspen Publishers Inc., Maryland.

Rare Fruit Council. (1981). *Tropical Fruit Recipes. Rare and Exotic Fruits*. Rare Fruit Council International Inc., Miami, Florida.

Samson, J.A. (1986). *Tropical Fruits*. Tropical Agricultural Series. Longman Scientific and Technical, New York.

Savage, F., S. King & A. Burgess. (1993). *Nutrition for Developing Countries*. Oxford Medical Press, Oxford.

Skinner, G. (1983). *Cuisine of the South Pacific*. Hodder and Stoughton, Auckland.

Sommers, P. (1990). Advancing Pacific Island food garden system: some observations and suggestions. In: Landauer, K. & M. Brazil (eds.). *Tropical Home Gardens*. United Nations University Press, Tokyo.

South Pacific Commission. (1983). *Banana*. South Pacific Foods Leaflet No. 7. Noumea, New Caledonia.

South Pacific Commission. (1983). *Coconut*. South Pacific Foods Leaflet No. 8. Noumea, New Caledonia.

South Pacific Commission. (1986). *Pineapple*. South Pacific Foods Leaflet No. 10. Noumea, New Caledonia.

South Pacific Commission. (1986). *Citrus Fruits*. South Pacific Foods Leaflet No. 11. Noumea, New Caledonia.



South Pacific Commission. (1992). *Pawpaw*. South Pacific Foods Leaflet No. 2 (rev. ed.). Noumea, New Caledonia.

South Pacific Commission. (1992). *Mango*. South Pacific Foods Leaflet No. 3 (rev. ed.). Noumea, New Caledonia.

South Pacific Commission. (1995). *Guava*. South Pacific Foods Leaflet No. 4 (rev. ed.). Noumea, New Caledonia.

Standal, B.R. (1979). Tropical foods of the Pacific region. In: Inglett, G.E. & G. Charalambous (eds.). *Tropical Foods: Chemistry and Nutrition*. Academic Press Inc., London. Vol. 1: 1-23.

Stanton, R. (1986). *Complete Book of Food and Nutrition*. Simon & Schuster, Australia.

Thaman, R.R. (1990). *Kiribati Agroforestry: Trees, People and the Atoll Environment*. Atoll Research Bulletin 33. Smithsonian Institution, Washington.

Tunidau, J., C. Bolabola, S. Parkinson & S. Tuivanuvou. (1990). *Preparation of Pacific Island Food*. The South Pacific Community Nutrition Training Project. University of the South Pacific/South Pacific Commission, Suva, Fiji.

Varsey, D.E. (1990). On estimating the net social and economic values of urban home gardens. In: Landauer, K. & M. Brazil (eds.). *Tropical Home Gardens*. United Nations University Press, Tokyo. pp. 203-213.

Wahlqvist, M.L. (1997). *Food and Nutrition in Australia, Asia and the Pacific*. Allen and Unwin Pty Ltd, Australia.

Walter, A. (1992). *L'arbre dans les îles: exploitation traditionnelle des arbres fruitiers à Vanuatu*. ORSTOM, Port Vila.

Watson, B.J., (1997). *Introduction of Fruit and Nut Trees to the Atoll Countries*. Technical Paper No. 221. South Pacific Commission, Noumea, New Caledonia.



Whistler, W.A. (1992). *Polynesian Herbal Medicine*. National Tropical Botanical Garden, Hawaii.

Williams, B. (1998). Significance of fruit production in the region and constraints to expansion. Paper prepared for the Regional Tropical Fruit Meeting, Noumea, New Caledonia 20–24 July, 1998.

Williams, S.R. (1993). *Nutrition and Diet Therapy*. Mosby, St Louis.





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## APPENDIX 1

### Summary of some fruits used in the Pacific Islands

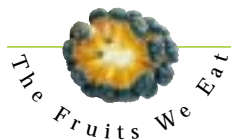
Fruit	Scientific name	Food value	Description	Preparation, cooking and use
Avocado	<i>Persea americana</i>	Contains 22% poly-unsaturated fat and some proteins. A good source of vitamin B.	Tear-drop shaped or round. Green when not mature; at maturity, some remain green and become soft, while others turn dark maroon.	Used in salads, dips, sweet and savoury dishes, ice cream, milk shakes, carbonated drinks and soups.
Banana	<i>Musa acuminata</i> (eaten raw) <i>Musa paradisiaca</i> (cooking variety)	Good source of energy. Contains some Vitamin B and C and iron. A good source of potassium (400 mg per 100 g).	Bananas are considered a fruit when they are ripe (yellow in colour) and staple when green.	Used in fruit salad, jam, drink, desserts, cake, chips, pudding; good weaning food for babies 6 months and over.
Custard apple and soursop	<i>Anona species</i>	High in water	Medium to large, dark green, oblong-conical fruits, normally irregular in shape. Some <i>Anona</i> (soursop) have spines. At maturity, colour changes to light green.	Eaten fresh, made into drinks, ice creams, sorbets, sherbet and jellies.
Grapefruit	<i>Citrus paradisi</i>	Good source of vitamin C and dietary fibre.	King-sized fruit shaped like an orange; light green to yellowish colour.	Best eaten fresh, used in marmalade, fruit juice, sauce, cake.
Guava	<i>Psidium guajava</i>	Good source of vitamin C and fibre.	Fruit is oval, 4–8 cm long. When ripe, dark green skin changes to light green or yellow and inside to white or pink.	Eaten ripe, makes a crunchy snack for children; used in jam, ice cream, drinks, stewed.
Jack fruit	<i>Artocarpus heterophyllus</i>	Excellent source of zinc, riboflavin and Vitamin C. Also contains dietary fibre, carotene, potassium and iron.	Can weigh up to 20 kg; pale greenish-yellow in colour. When ripe, the skin changes to a yellowish brown. The ripening process takes 6–8 months.	Eaten raw or used in curry, stews, soups, desserts, milk drink, ice cream and fruit salad.



Fruit	Scientific name	Food value	Description	Preparation, cooking and use
Jambolan	<i>Eugenia brasiliensis</i>	Excellent source of iron, has high water content and contains some sodium.	When ripe, colour changes from light green to dark purple. The fruit is about 4 cm (1½ inch) long.	Eaten raw or made into jams, juice, preserves or wine.
Kumquat	<i>Fortunella japonica</i>	Very good source of Vitamin C and some dietary fibre.	Small, round or elongated, with spicy, bright orange skin.	Whole fruit can be eaten, or used in drinks, jam-making, preserves, as garnishes for other dishes.
Lemon	<i>Citrus limon</i>	Very good source of Vitamin C and dietary fibre.	Round; pale green to yellow; rough skin; similar in size to an orange.	Drink, marinating fish, pie, add to flavourings and garnishes.
Lime	<i>Citrus aurantifolia</i>	Very good source of Vitamin C.	Round; thin smooth skin; pale green colour; some are seedless.	Used in drinks, flavour enhancers, jam-making, desserts, to marinate fish.
Lychee	<i>Litchi chinensis</i>	Good source of vitamin C, with moderate amount of dietary fibre.	Fruit resembles a small plum. When mature, the green colour of the skin change to reddish brown.	Eaten raw, in fruit salads, ice cream, made into preserves, processed into a "nut".
Mandarin	<i>Citrus reticulata</i>	Good source of Vitamin C, carotene & dietary fibre.	Flattened round shape, slightly smaller than an orange; green or yellow-orange.	Eaten fresh, used in jam-making, sauce, preserves, cake, garnishes and drinks.

Fruit	Scientific name	Food value	Description	Preparation, cooking and use
Mango	<i>Mangifera indica</i>	Excellent source of Vitamin C and Vitamin A. Also contains small amounts of potassium and other minerals and vitamins.	Round or oval. When it ripens, the green skin changes to yellow, orange or red.	In drinks, salads, desserts, chutneys, pickles, curries, garnishes; as a flavour for meat, fish and chicken; sauce, flavour for dip.
Nandau	<i>Pometia pinnata</i>	Good source of Vitamin C, some dietary fibre. Also contains small amounts of minerals.	Round, with thin green or reddish-purple skin and sweet, translucent, jelly-like flesh.	Eaten raw. Edible seeds can be dried and stored.
Orange	<i>Citrus sinensis</i>	Good source of Vitamin C, dietary fibre.	Round and smooth; green, yellowish to orange colour.	Best eaten fresh. Can be made into jam. Used in salads, drinks, sauce, cake. Oils from peel used in production of perfume.
Pandanus	<i>Pandanus tectorius</i>	Good source of Vitamin A and dietary fibre. Also contains some Vitamin C, thiamin, riboflavin and niacin.	Bunch is made up of tiny fruit fingers (phalanges), all hung together in a cluster. Weight of each finger ranges from approximately 60 to 200 g (2–4 ounces). The fingers turn red or yellow when ripe.	Eaten fresh, drinks, cooked, pounded and mixed with coconut cream or grated coconut into a paste.
Passionfruit	<i>Passiflora edulis</i>	Provides a fair amount of Vitamin C and niacin.	Green to brown skin when unripe, turning to yellow or deep purple when mature. Contains orange pulp mixed with small black seeds.	Eaten fresh, added to fruit salad, ice cream, juice, meringue pie.





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Fruit	Scientific name	Food value	Description	Preparation, cooking and use
Pawpaw (papaya)	<i>Carica papaya</i>	Excellent source of Vitamin C, good source of Vitamin A.	Shape, size and colour vary between varieties.	Green pawpaw: stew, curry, sauces, salad, stuffed. Ripe pawpaw: eaten fresh, drinks, fruit salad, pudding, desserts, preserves, wine, chutneys, cakes, scones. Seeds of ripe pawpaw: used in salad dressing. Sap of leaves and fruit: as meat tenderiser.
Pineapple	<i>Ananas comosus</i>	Provides some Vitamin C, dietary fibre and small amounts of other vitamins and minerals.	Fruit of this low-growing plant forms on a short stalk and is brown or green when immature and yellow when ripe.	Eaten fresh, in drinks, desserts, salad, processed, canned, dried, as garnish, casserole, flavour for dip, sauce, jam, chutneys.
Pomelo	<i>Citrus grandis</i>	Good source of Vitamin C, and dietary fibre.	Large, round, slightly pear-shaped, with thick, pink, yellow or white skin. Flesh tastes sweet/sour.	Eaten fresh or made into drinks, jams or candied fruits.
Star fruit (carambola)	<i>Averrhoa carambola</i>	Has a high water content. Also contains some Vitamin C, dietary fibre and small amounts of minerals and other vitamins.	The five longitudinal ridges on the fruit make it attractive when cut. When fruit matures it turns yellow, light green or off-white.	As snack, juice, fruit salad, vegetable salad, pickles, desserts, dried, sauce.

Fruit	Scientific name	Food value	Description	Preparation, cooking and use
Tamarind	<i>Tamarindus indica</i>	Good source of sodium, potassium, thiamin and riboflavin. Also has some iron.	Fruit is narrow, 5—10 centimetres long. Mature pods have distinctive brown colour and when broken expose brown, sticky flesh covering the dark-brown seeds.	Makes delicious snacks, chutney, sauce, dried.
Tarawau	<i>Dracontomelom vitiense</i>	Excellent source of potassium, calcium and iron.	Bunches of small, yellow-orange fruit.	Fresh snacks.
Watermelon	<i>Citrullus lanatus</i>	Refreshing fruit, contains lots of water.	Different varieties; weight can range from 2 to 25 kg. Green skin; when ripe, the white flesh changes to red, pink or yellow.	Eaten fresh, juice, fruit salad, skin can be pickled.
Wi	<i>Spondia dulcis</i>	Good source of Vitamin C and fibre.	Round or oval fruit 4–10.5 cm (1.7–4 in) long. When fruit ripens, colour changes from green to yellowish brown.	Eaten fresh, stewed, chutney, jam, juice.



## APPENDIX 2

### Nutrient composition of some fruits

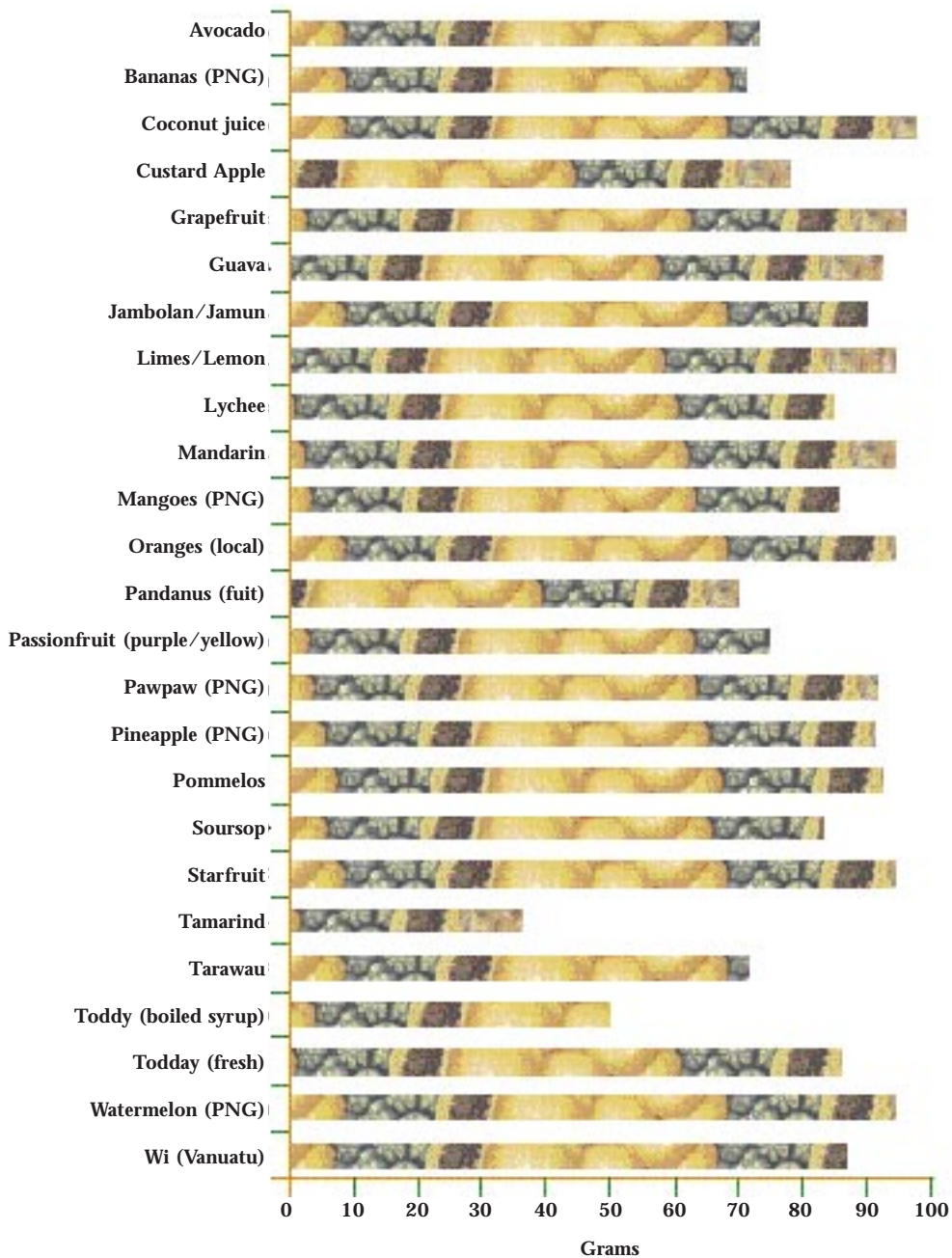
The figures on the next 16 pages highlight the nutrient values found in 25 different Pacific fruits. They cover water, energy, protein, fat, carbohydrate, dietary fibre, sodium, potassium, calcium, iron, zinc, Vitamin A, thiamin, riboflavin, niacin and Vitamin C content.

Where there is a blank on the bar graph, this mean that the value is zero, traces so small that they could not be measured during the analysis, or less than 0.5 unit of measure.



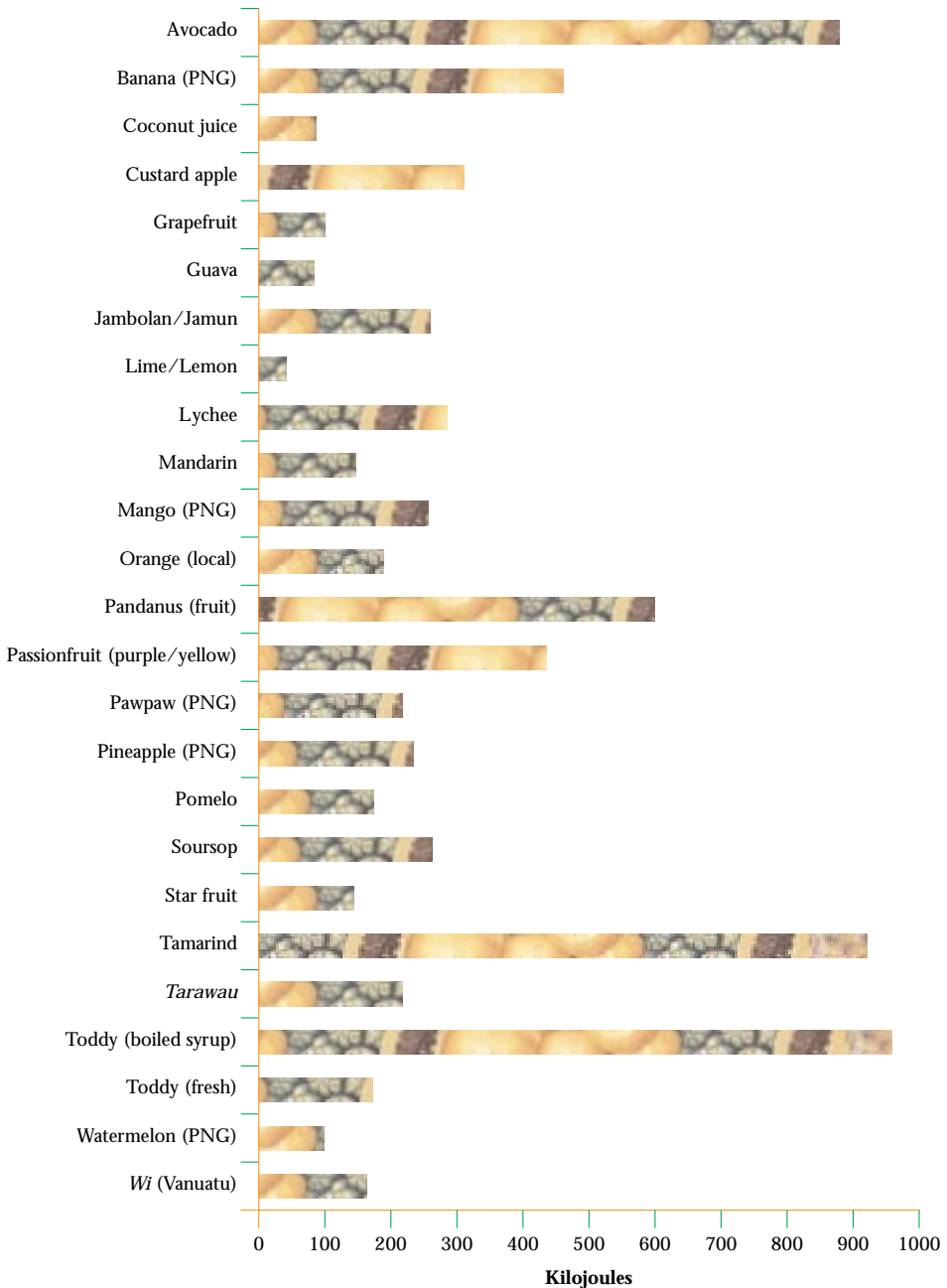


Figure 1: Water content (g/100 g) of fresh food



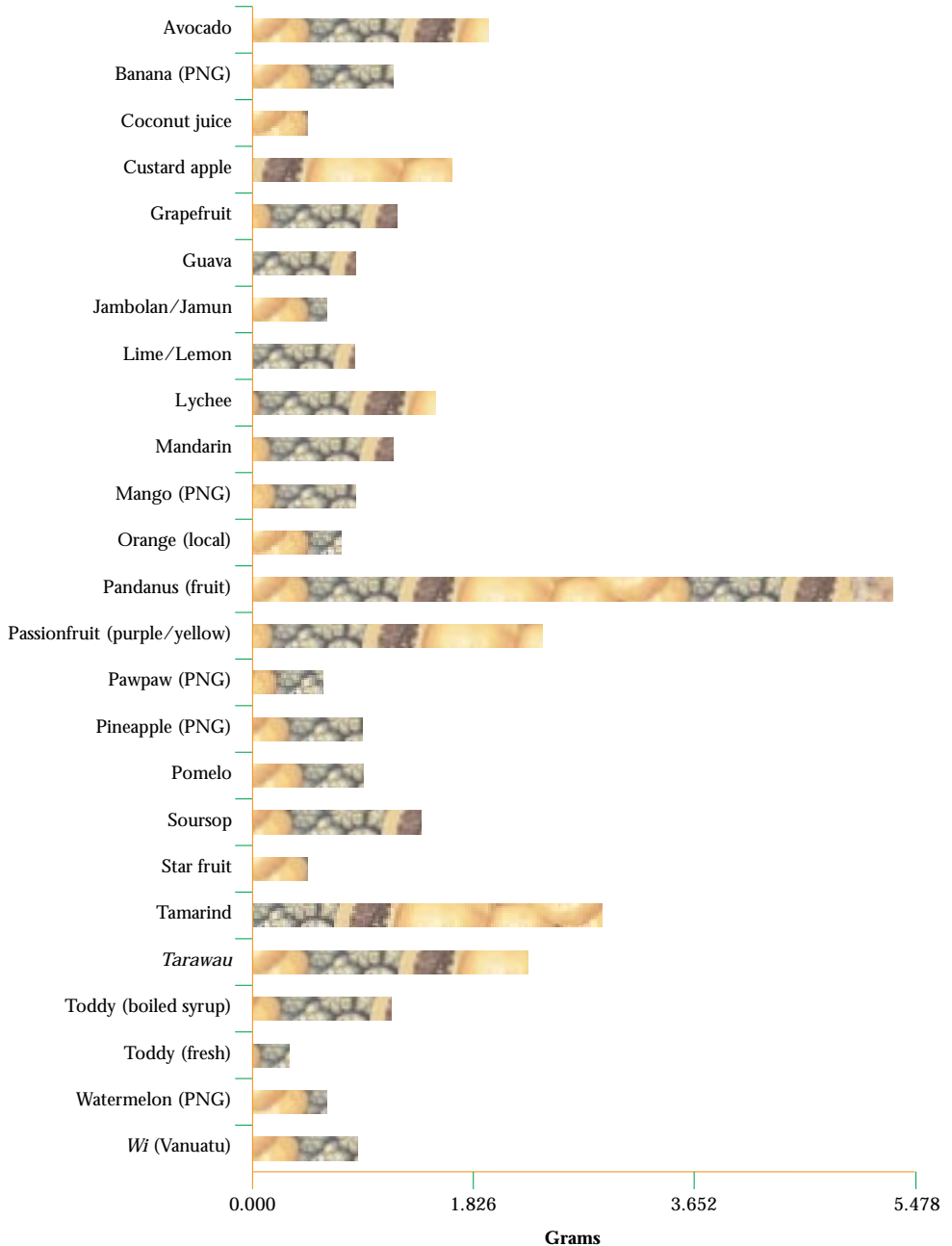


**Figure 2: Energy content (KJ/100 g) of fresh food**





**Figure 3: Protein content (g/100 g) of fresh food**



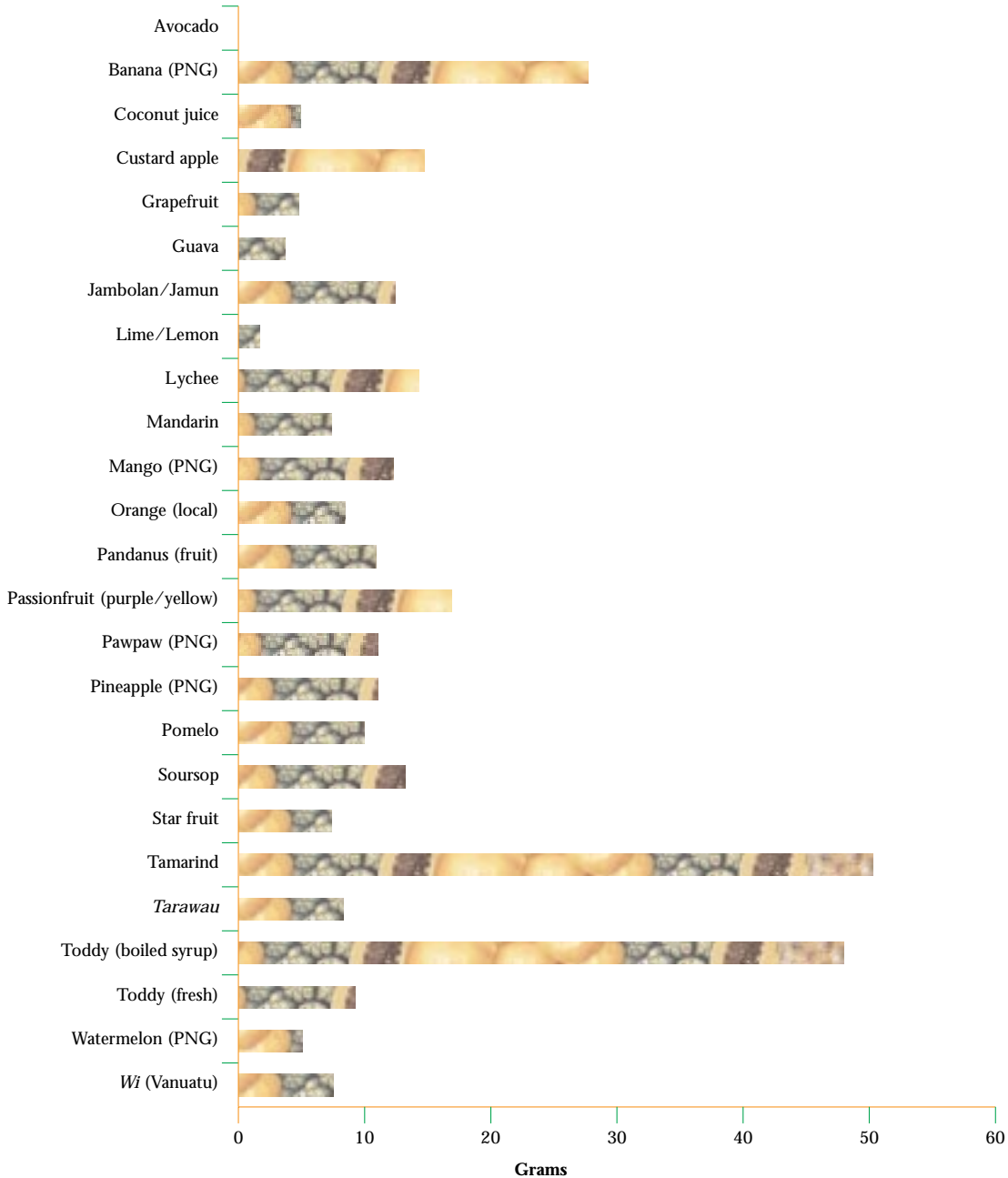


**Figure 4: Total fat content (g/100 g) of fresh food**



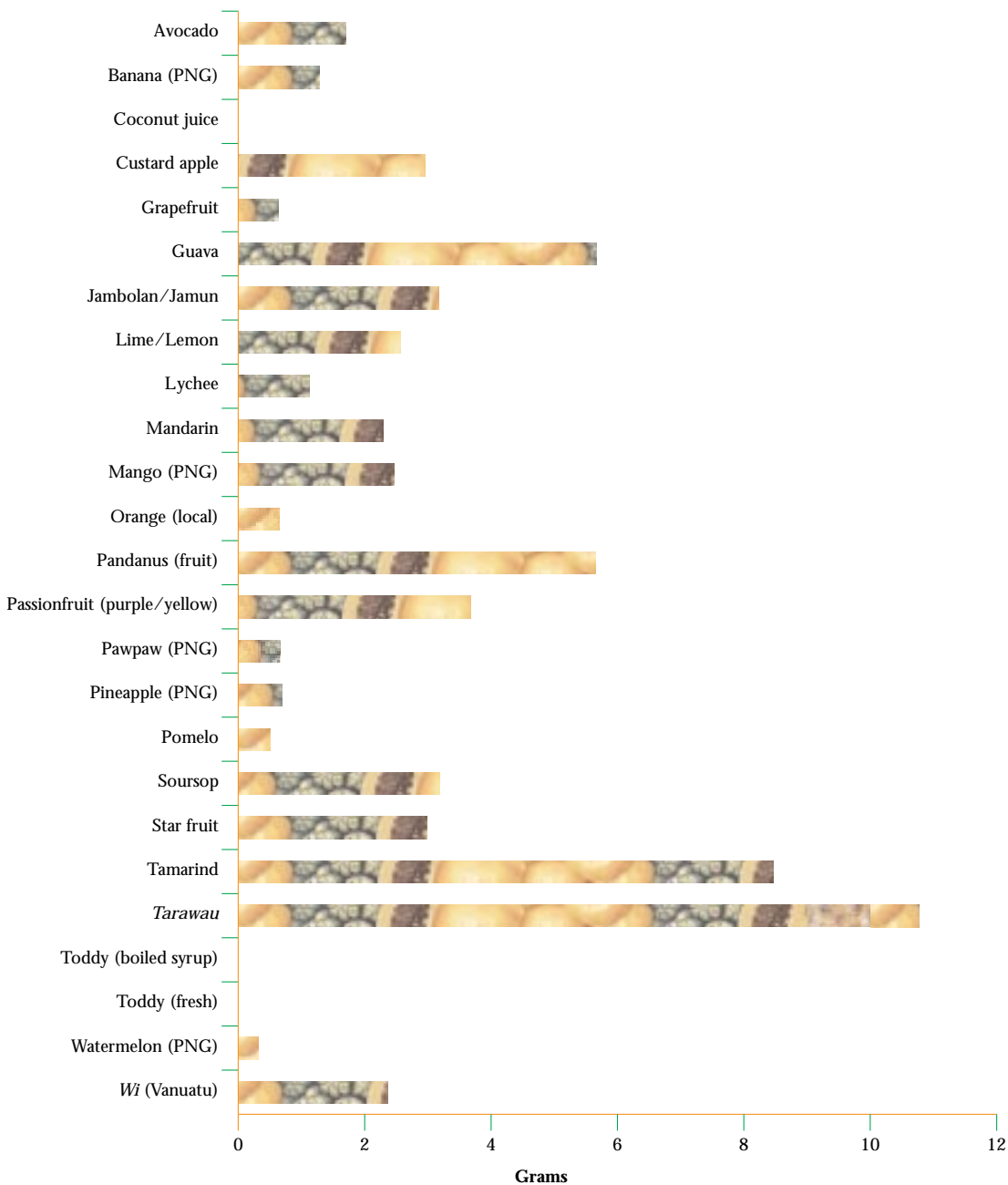


**Figure 5: Total carbohydrate (g/100 g) of fresh food**



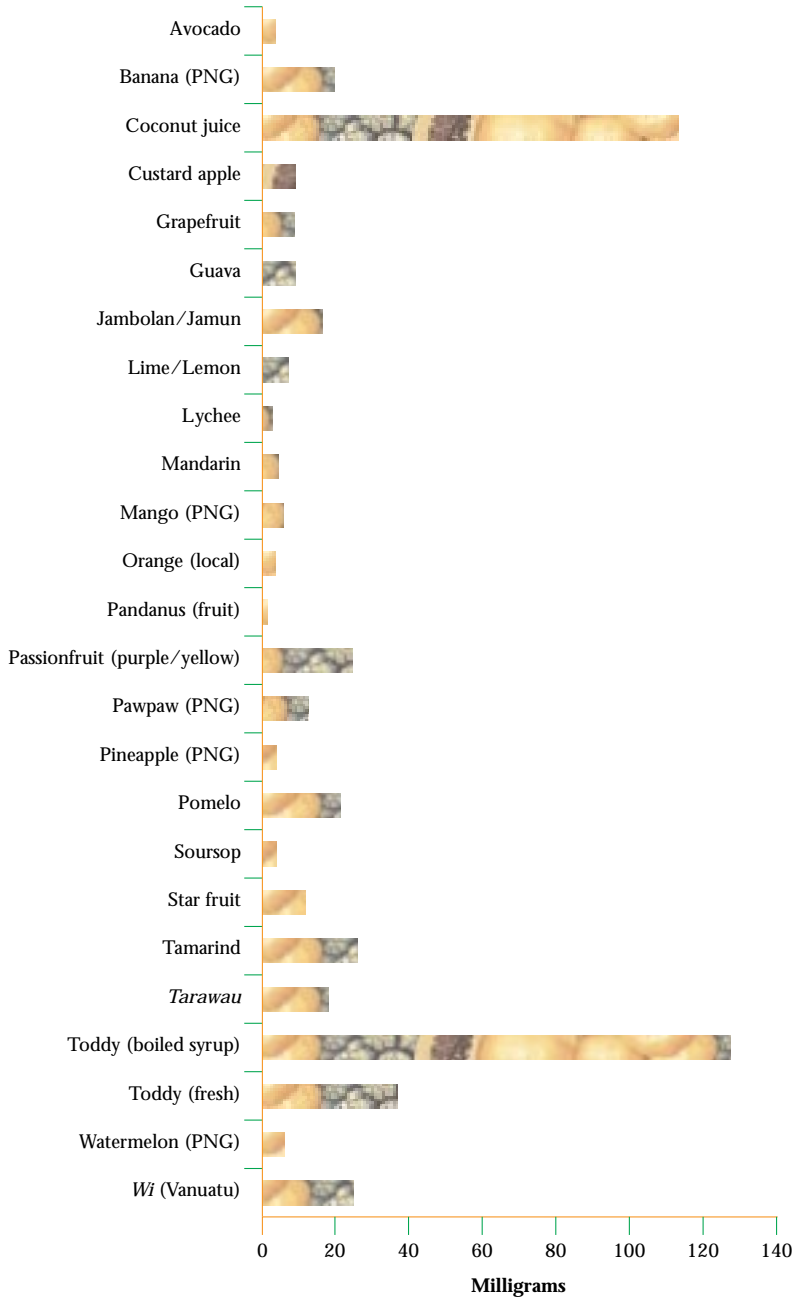


**Figure 6: dietary fibre content (g/100 g) of fresh food**



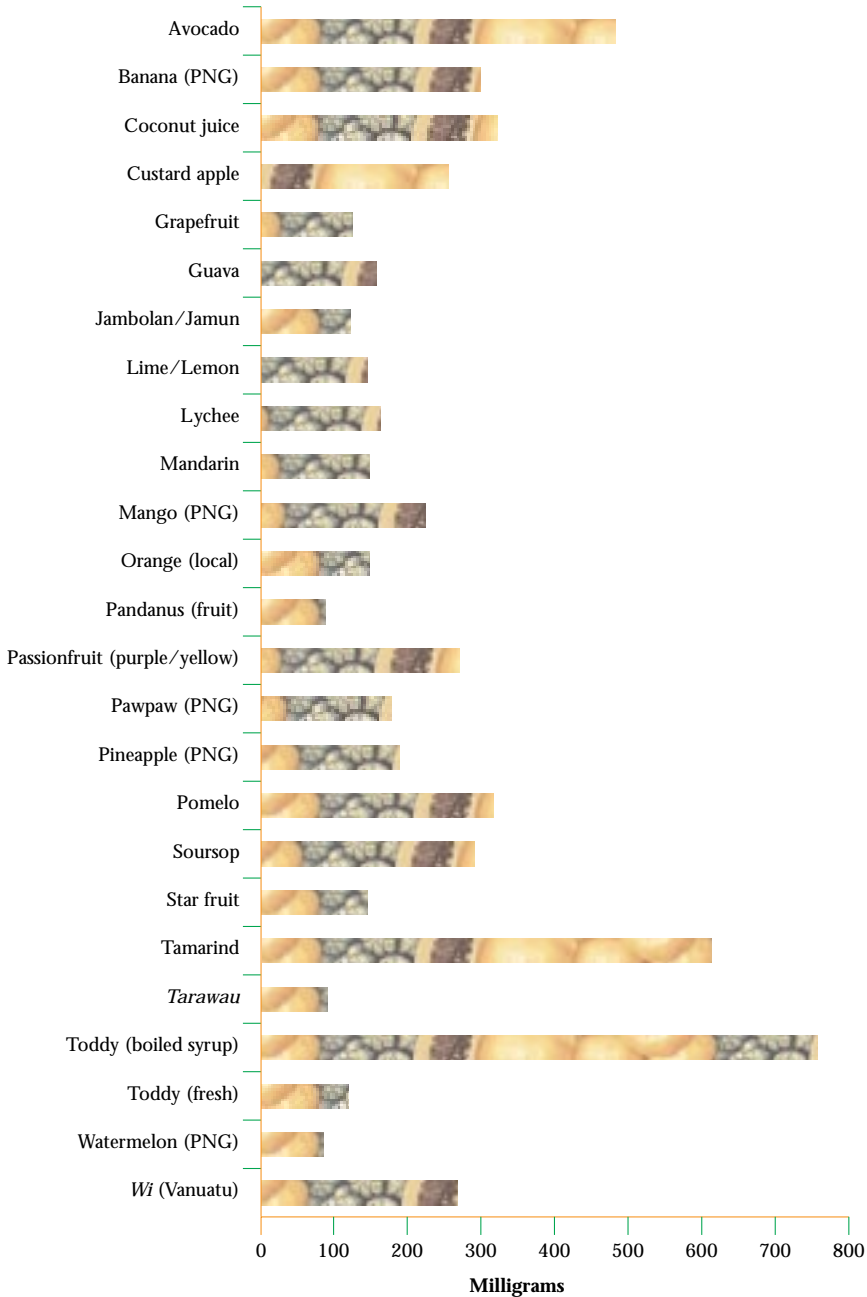


**Figure 7: Sodium content (g/100 g) of fresh food**





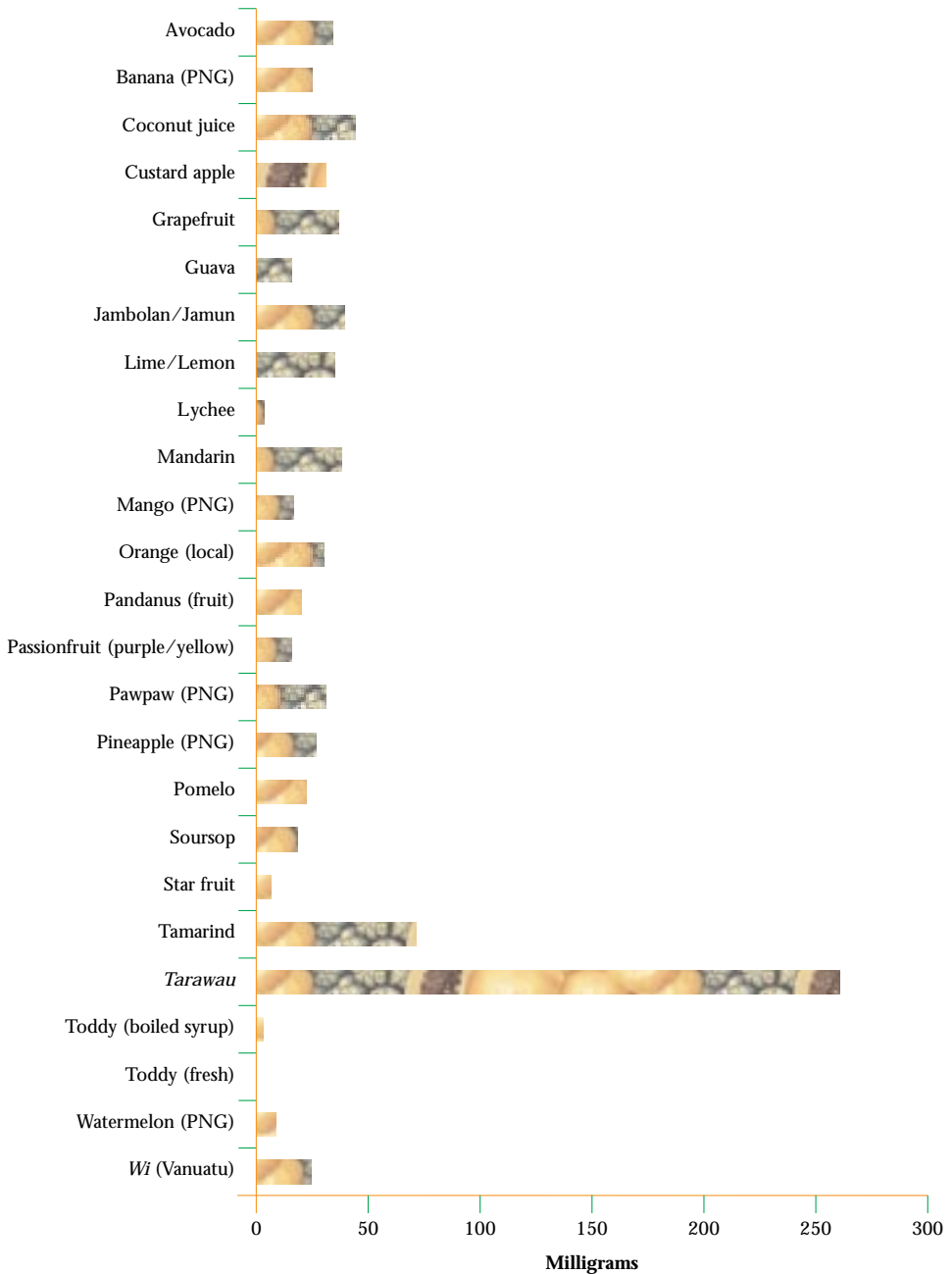
**Figure 8: Potassium content (g/100 g) of fresh food**





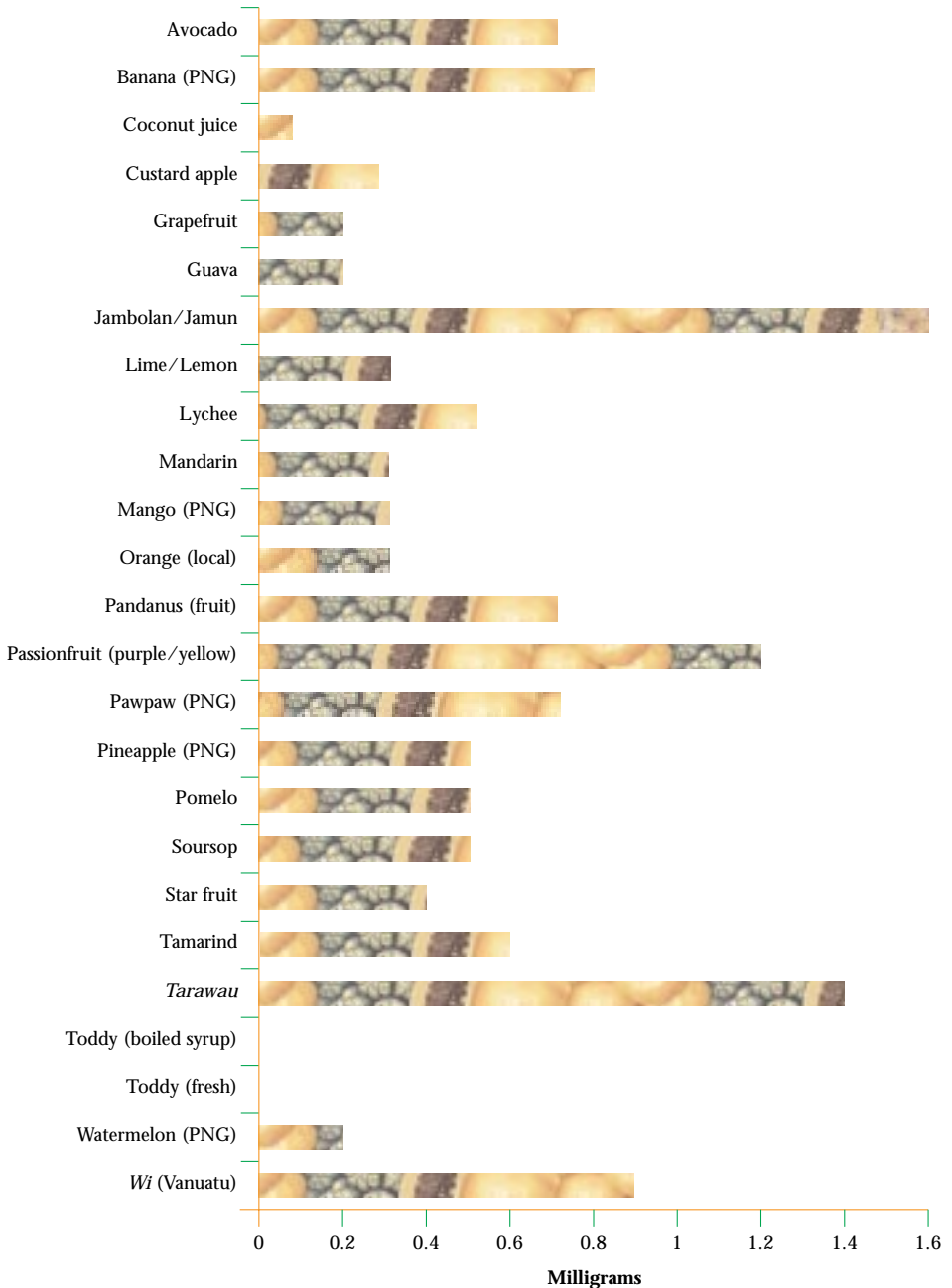


**Figure 9: Calcium content (g/100 g) of fresh food**



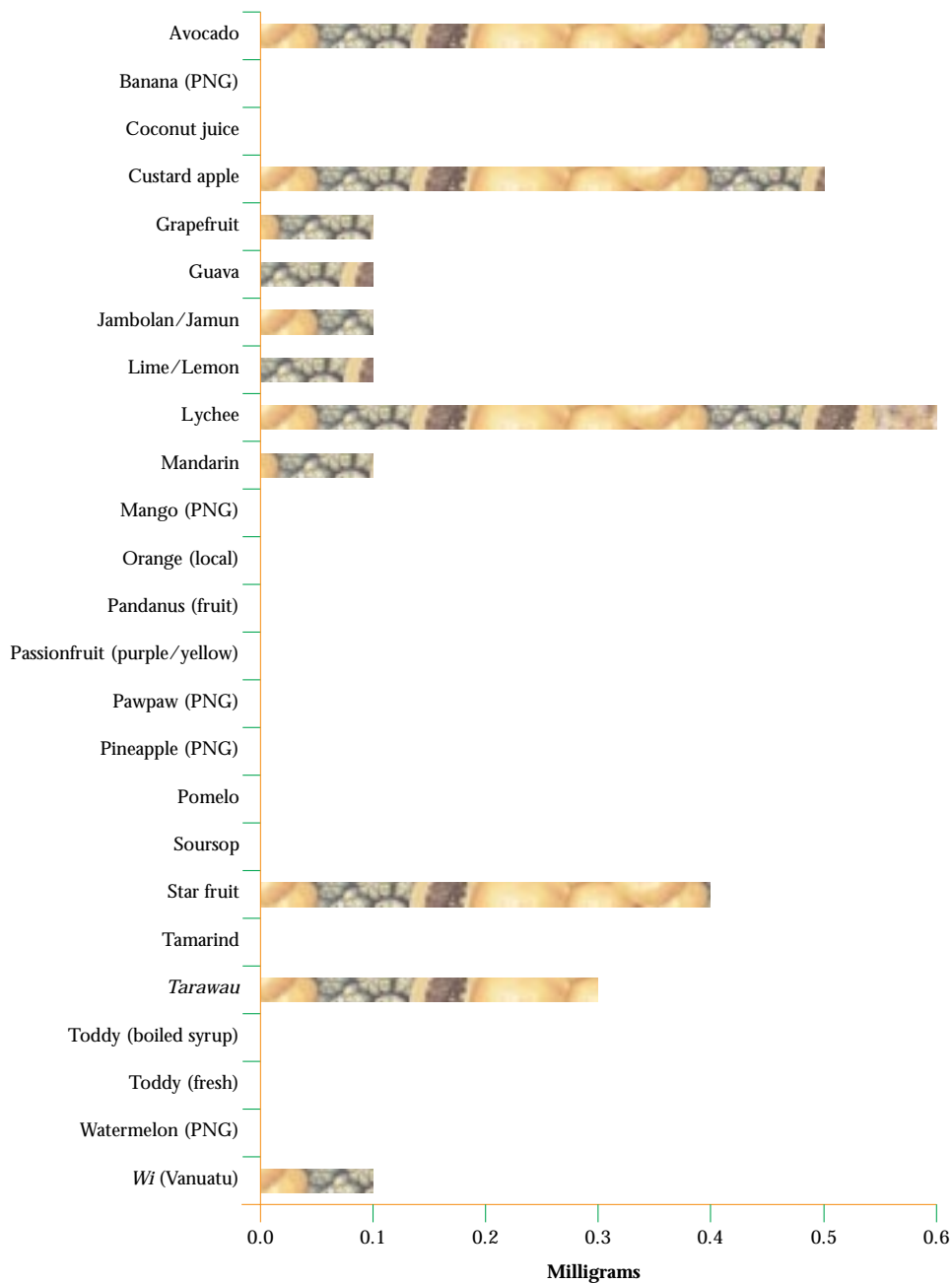


**Figure 10: Iron content (g/100 g) of fresh food**



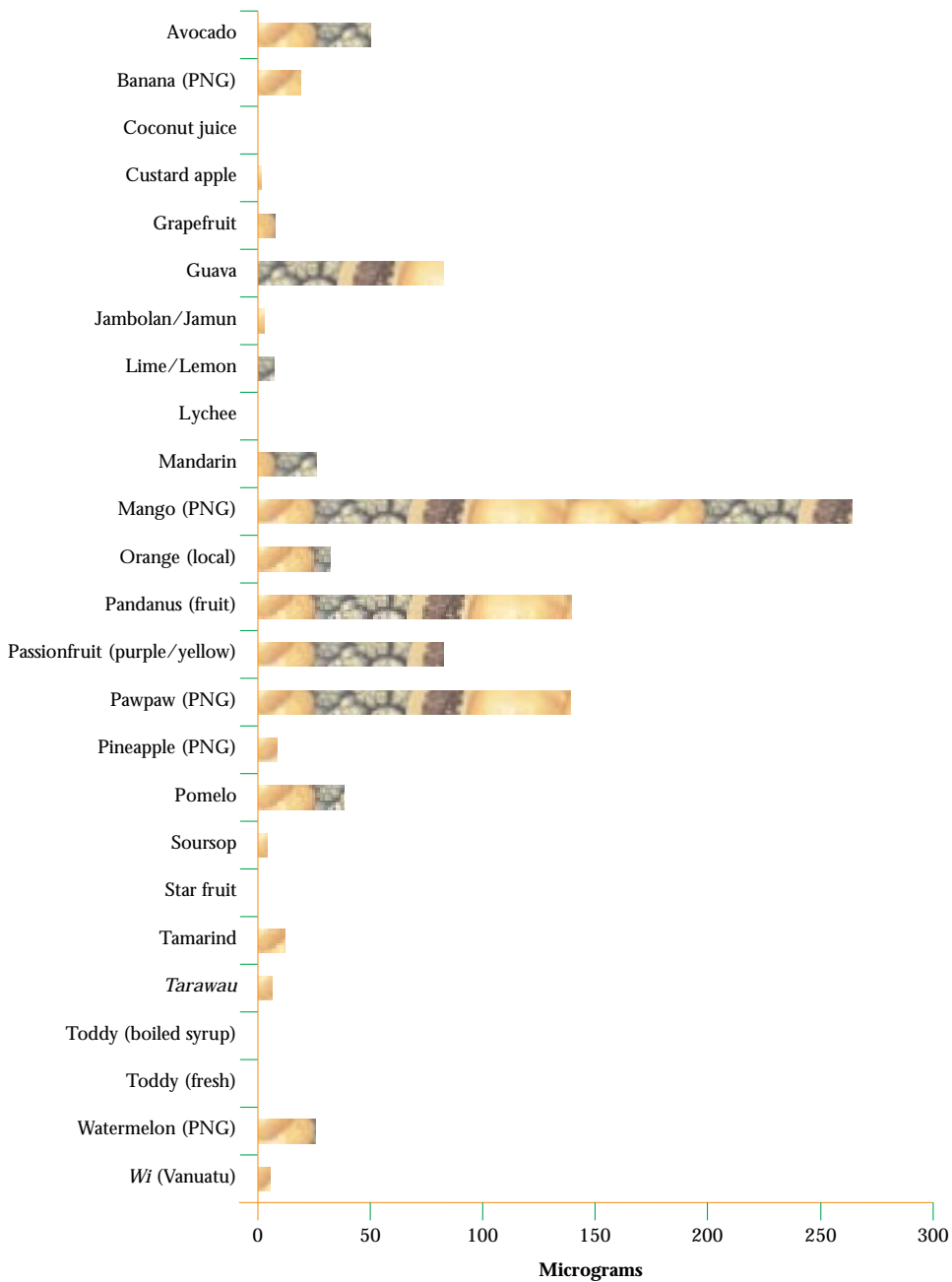


**Figure 11: Zinc content (g/100 g) of fresh food**



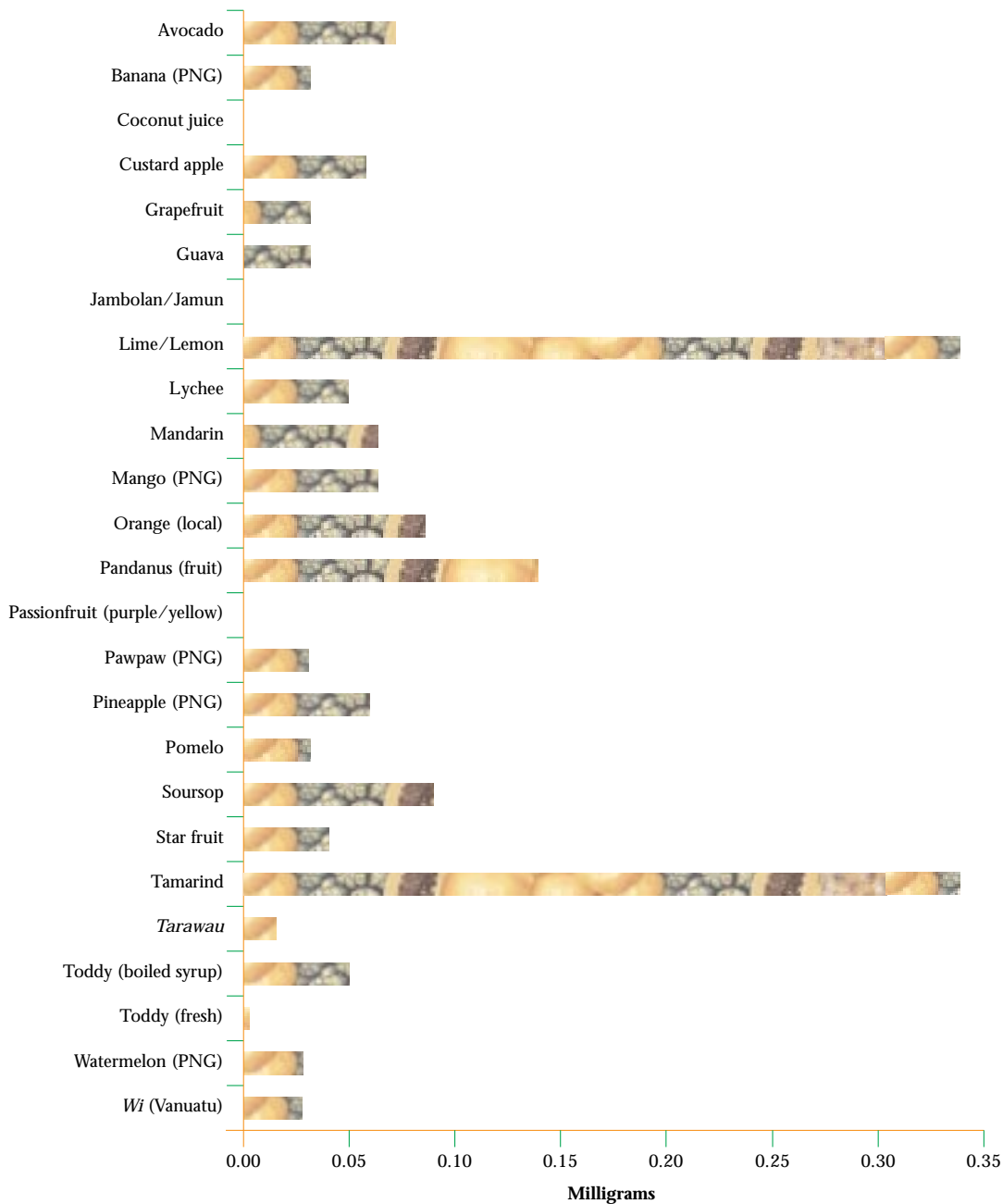


**Figure 12: Vitamin A content (g/100 g) of fresh food**



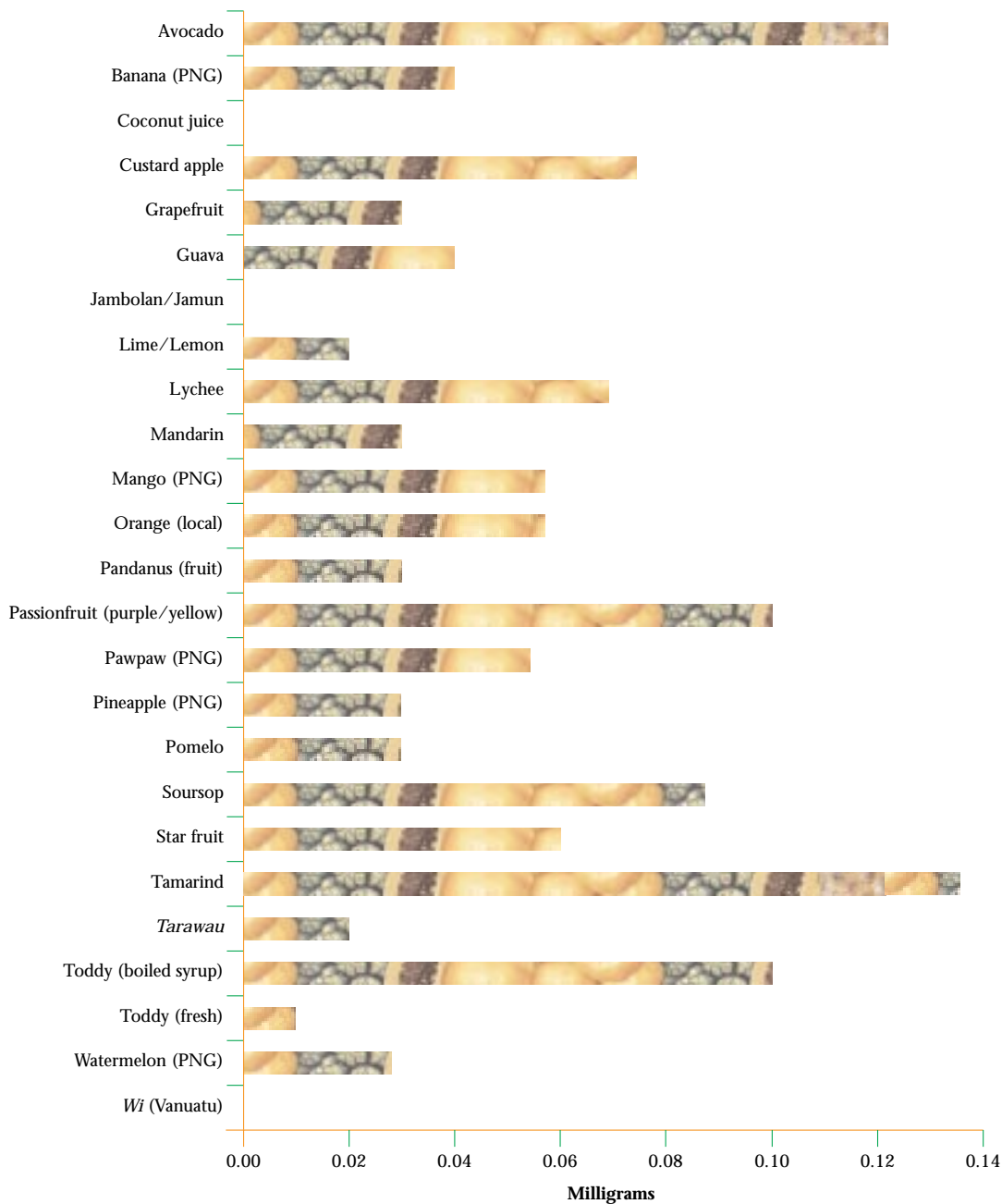


**Figure 13: Thiamin (B<sub>1</sub>) content (g/100 g) of fresh food**



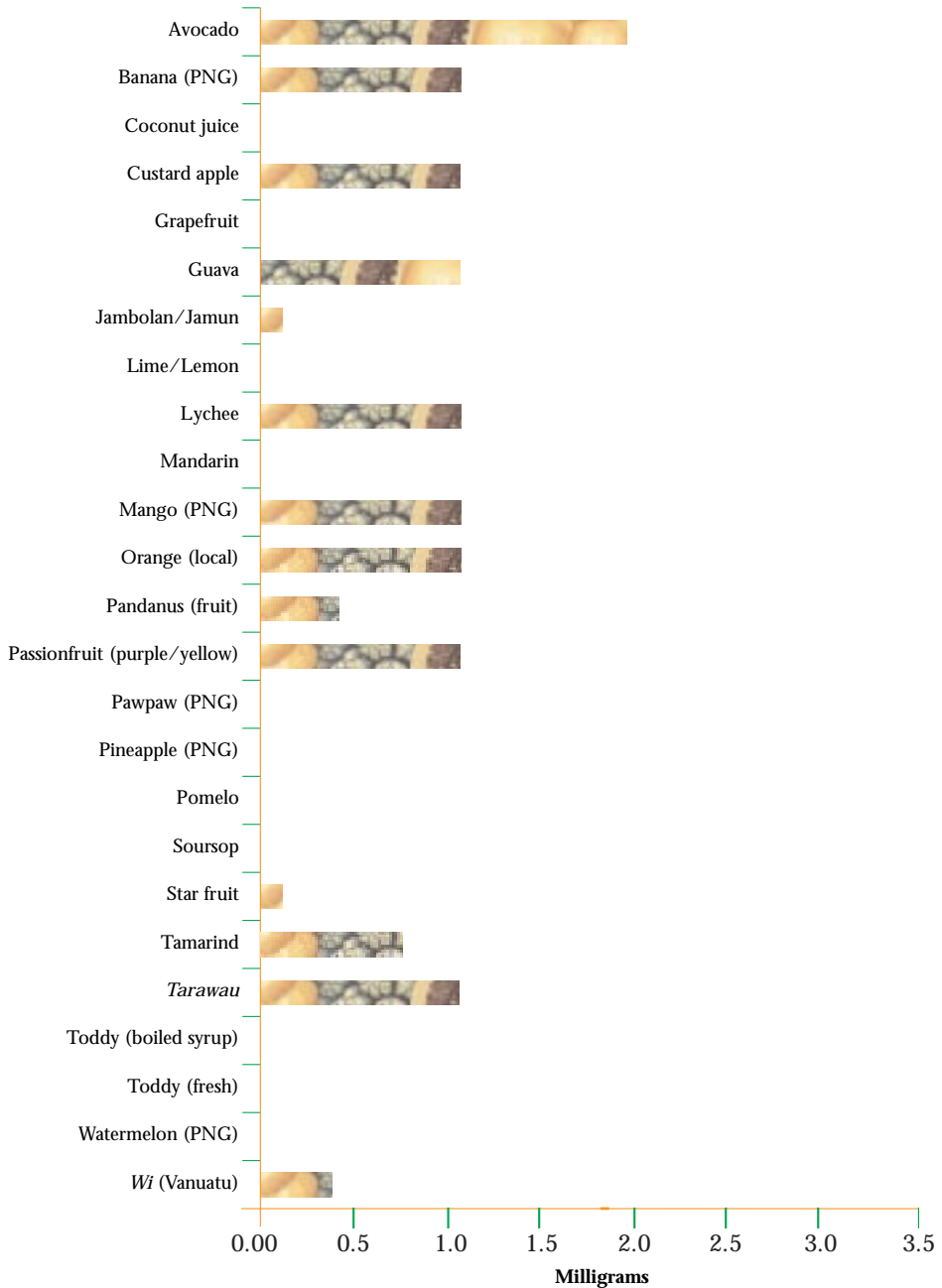


**Figure 14: Riboflavin (B<sub>2</sub>) content (g/100 g) of fresh food**





**Figure 15: Niacin content (g/100 g) of fresh food**





**Figure 16: Vitamin C content (g/100 g) of fresh food**

