



BANANA CHIPS

Introduction

There are two different methods for making banana chips. One of these is to deep fry thin slices of banana in hot oil, in the same way as potato chips or crisps. The other is to dry slices of banana, either in the sun or using a solar or artificial dryer. The products made by the two methods are quite different. The deep fried chips tend to be a savoury, high calorie product that is eaten as a snack food. Because they are deep fried in oil they have a fairly short shelf life- up to 2 months maximum when stored in the correct conditions. The oil is prone to turning rancid and the crisps to becoming soft if they are not stored in air-tight containers.



Figure 1: Banana chips.
Photo: Neil Noble / Practical Action.

The dried chips are a more 'wholesome' product. They too are eaten as a snack food and are often added to cereal mixes such as muesli. The chips can be dried without any additives or they can be coated with a syrup or honey dip prior to drying which gives a sweeter tasting, higher calorie and possibly more attractive looking product. Chips made by drying have a longer shelf life (up to 6 months) as long as they are dried to a low moisture content and stored in a cool dry place.

Bananas can also be dried whole or in long strips until they are leathery and chewy. They have a higher sugar content and are not crispy like the dried chips. They are sometimes referred to as banana figs.

This brief explains how to make fried banana and plantain chips and dried banana chips. Any starchy fruit such as under-ripe jackfruit (*Artocarpus heterophyllus*).

Fried banana chips

Principles of preservation

Under-ripe mature banana or plantain is cut into thin slices and fried to a crisp texture. The slices can be partially dried before frying which removes some of the moisture and makes them more crispy. Frying removes some of the water, gelatinizes the starch, destroys enzymes and micro-organisms and gives a crisp product with a characteristic aroma and taste. The low moisture content inhibits microbial growth and packaging prevents recontamination.

Equipment needed

- Knives or small fruit slicer
- Plastic buckets or bowls for soaking fruit
- Plastic sieve for draining the soak water
- Drying trays (solar drying)
- Drying cabinet (for assisted drying)
- Large frying pan or wok
- Thermometer
- Polythene bags
- Bag sealer

Selection of raw material

It is essential to use under-ripe green bananas as these have the correct texture for drying and frying. If plantain is used, select nearly ripe fruit that has stiff and starchy flesh. Ripe and over ripe bananas and plantains should not be used as the texture is too soft to make the chips.

For banana figs, fully ripe fruits with a sugar content of about 20% are used.

Preparation of raw material

Bananas should be peeled just before they are used because when the flesh is exposed to the air it turns brown. This does not affect the eating quality but it does not look very attractive. Peeled bananas can be prevented from turning brown by brushing them with a solution of ascorbic acid (vitamin C) or the juice from lemon, lime or orange. Alternatively, the peeled banana slices can be soaked in a solution of citric acid (made by mixing 1 part lemon juice with 2-3 parts water) for 3-5 minutes. Do not leave the slices in the water for longer than this as they become too wet and soft and will take longer to dry. Remove the slices from the water and allow to drain.

Slice the bananas crosswise or diagonally crosswise for the smaller bananas into slices that are about 5-8mm thick. Try to ensure that all pieces are the same thickness so that they all dry and fry at the same rate. A packet of banana chips of varying thicknesses is less attractive than one in which the pieces are of uniform thickness. You can use a small kitchen slicer to ensure that the pieces are of uniform thickness.

Pre-treat the slices with acidified water, a solution of ascorbic acid, a fruit juice dip or a honey dip to prevent them from browning.

Ascorbic acid solution: Ascorbic acid (vitamin C) mixed with water is a safe way to prevent fruit browning. In some places, ascorbic acid is available in the powdered or tablet form, from pharmacies or grocery stores. One teaspoon of powdered ascorbic acid is equal to 3000 mg ascorbic acid in tablet form. (If you buy 500 mg tablets, this would be six tablets). Mix 1 teaspoon of powdered ascorbic acid (or 3000 mg of ascorbic acid tablets, crushed) in 2 cups water. Place the fruit in the solution for 3 to 5 minutes. Remove fruit, drain well and place on the dryer trays.

Fruit juice dip: A fruit juice that is high in vitamin C can be used as a pre-treatment, though it is less effective than pure ascorbic acid. Juices high in vitamin C include orange, lemon, pineapple, grape and cranberry. Each juice adds its own colour and flavour to the fruit. Place enough juice to cover the fruit in a bowl. Add the cut fruit and soak for 3 to 5 minutes. Remove fruit, drain well and place on dryer trays. This solution can be used twice before being replaced (the used juice can be consumed).

Honey dip: Mix 1 cup of sugar with 3 cups of boiling water. Add 1 cup of honey to the sugar mix and stir to make a liquid dip. Either place the banana slices into the dip for 3-5 minutes and then remove, or brush the chips with the dip after they have been placed on the dryer tray. Dried banana chips dipped in honey are sweeter and have a higher energy value than those that are not dipped. Many of the commercially available banana chips have been dipped in honey or a syrup solution prior to drying.

Fried banana chips

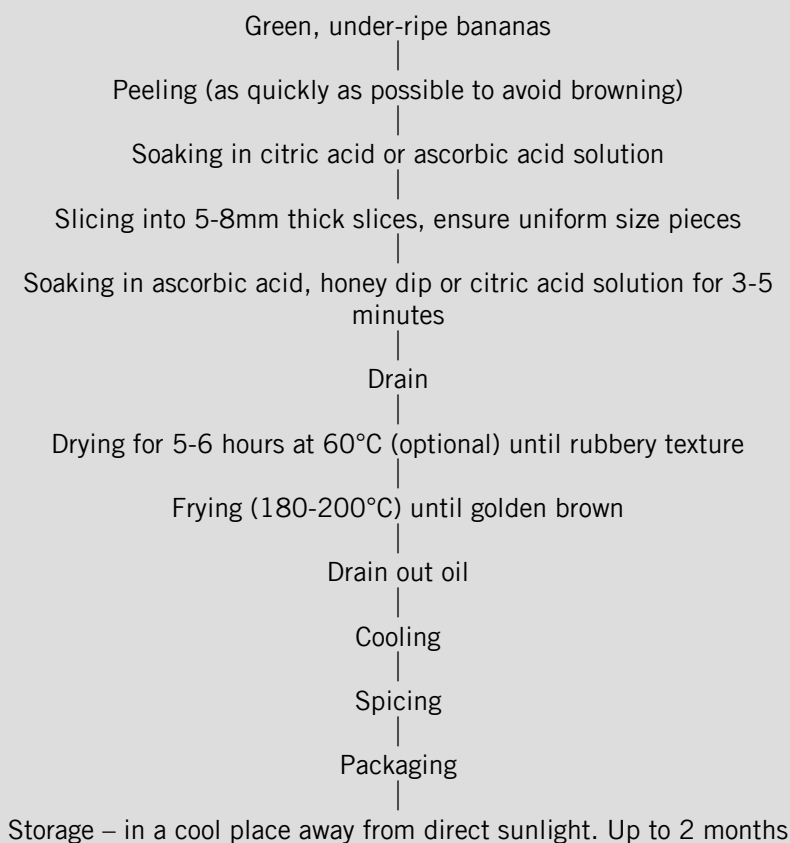
Some processors partially dry the banana chips before frying them. This is to remove some of the moisture from the chips before drying, which results in crispier banana chips. However, during the time that they are drying, the banana slices are prone to darkening which reduces the quality of the final product. You can also fry the banana slices without drying them. If you soak them in a syrup or salt solution before frying, drain them well before drying to ensure that they are dry before they go in the oil.

Dry the sliced bananas for a short time (5-6 hours in a cabinet dryer or up to 2 days in a solar dryer) until they have a soft rubbery texture. The length of time taken for drying depends on the thickness of the banana slices, the temperature of the dryer and the drying conditions.

Heat good clean vegetable oil to 180-200°C. Use a thermometer to check the temperature of the oil because if it is too hot, the chips will burn and the oil will deteriorate more rapidly (see the box on quality of oil and frying). If the oil is not hot enough, the chips will soak up too much oil before they fry. A thermostatically controlled deep fat fryer is useful if you have one available. The oil should not be used for frying more than three to four times as it deteriorates each time it is heated and this will spoil the flavour of the chips.

Add a few banana chips to the oil (enough so that one layer of chips fit into the pan). If you add too many chips at one time the temperature of the oil will drop and the chips will take longer to cook. Fry the banana chips. Remove them from the oil with a straining spoon when they rise to the surface of the oil and are a golden brown colour. The chips will cook very quickly, so take care that they do not burn. The more chips in the oil at any one time, the longer they will take to cook. It is useful to have a mesh basket for frying the chips as this enables you to remove them from the oil more quickly when they are ready. The chips are placed into the mesh basket, this is lowered into the hot oil, shaken a little to move the chips around in the oil and then lifted out as soon as the chips are golden brown. For larger operations, it is useful to have more than one basket so that one can be removed from the fryer, the oil allowed to return to the desired temperature and then a second basket is lowered in.

Fried banana chips - process flow-chart



Leave the chips in the basket to drain off the excess oil (collect this oil as it can be returned to the fryer and re-used).

When the chips have cooled slightly, and while they are still sticky with the warm oil, add the desired flavourings - for example salt, pepper or chilli powder. Cool to room temperature, weigh into moisture proof, airtight bags, label and seal the bags. Store the bags in a cool place away from direct sunlight. The fried chips have a short shelf life of about 2 months, so make sure that they are sold or consumed well within this time.

Plantain chips

A similar fried product can be made from green plantain, which is a cooking banana. The slices of plantain are fried in palm oil and sprinkled with salt. The palm oil gives the chips a reddish golden colour. The chips are about 2mm thick, have a crisp texture and a starchy, salty taste. They have a shelf life of 2-3 months if packed in moisture proof packets and stored in a cool place.

Selection and preparation of raw material

Use nearly ripe fruit in which the flesh is stiff and starchy – over-ripe fruit cannot be used as the texture is too soft. Wash well in clean water to remove dirt and surface micro-organisms. Remove the skins. Only peel the plantain when you are ready to use them or the flesh will start to turn brown. Store the peeled plantain in acidified water (1 part lemon juice to 2-3 parts water) to slow down the browning reaction.

Cut by hand or using a manual slicer to give slices approximately 2mm thick. Make sure that the slices are all uniform thickness so that they cook at the same rate.

Soaking of slices

Dip the slices of plantain in a solution of 5% salt for 10-20 minutes. Remove from the water and drain to remove the excess water.

Fry

Place the chips in a mesh basket and lower into the oil. Deep fry in palm oil at about 150°C for 2-3 minutes until crisp and golden. Lift out the basket as soon as the chips are golden brown. Leave the chips in the basket to drain off the excess oil (collect this oil as it can be returned to the fryer and re-used). For larger operations, it is useful to have more than one basket so that one can be removed from the fryer, the oil allowed to return to the desired temperature and then a second basket is lowered in.

Make sure that the temperature of the oil does not get too high or the chips will burn. If available, use a thermostatically controlled fryer. If not, use a thermometer to check the temperature. Do not use the frying oil more than 3-4 times as it will start to turn rancid and give the chips an off flavour.

When the chips have cooled slightly, and while they are still sticky with the warm oil, add the desired flavourings - for example salt, pepper or chilli powder. Cool to room temperature, weigh into moisture-proof, airtight bags, label and seal the bags. Store the bags in a cool place away from direct sunlight. The fried chips have a short shelf life of about 2 months, so make sure that they are sold or consumed well within this time.

Oil, frying and quality control

Most oils used for frying are of vegetable origin but there is no reason why animal fats cannot be used. The oil used has a great impact on the taste, texture and keeping quality of the final product. For example, palm oil gives products a red colour. Mustard seed oil gives fried foods a distinctive sulphur-like flavour. Fats and oils are subject to a type of deterioration known as rancidity. This produces disagreeable odours and flavours and makes the fried foods unpalatable. Some oils are more prone to rancidity than others and this is important when considering which oil to use. In many countries, however, there is only one type of oil widely available at the lowest cost and processors will use this, despite rancidity problems, if it gives a flavour that is acceptable.

The amount of oil required for frying will vary according to whether the product is to be shallow fried or deep fried. The temperature to which the oil is heated is not limited by a boiling point as with water. Heated oil does however reach a stage at which it breaks down to fumes, which is known as the smoke point. It is important that oils do not reach the smoke point when used for frying as this will cause the oil to deteriorate more rapidly and increase the danger of it catching fire. Suitable temperatures for frying are between 180 and 200°C. Frying can take place using a simple pan heated by an open fire or other heat source. Alternatively, for deep frying, an electrically powered fryer fitted with a thermostatic control gives more control over heating for larger quantities of food.

At the end of the frying operation, the oil should be left to cool and then filtered to remove all particles of food that have accumulated in the bottom of the pan or fryer. These burnt pieces of food will cause the oil to spoil more rapidly.

The cost of oil is one of the major factors to calculate when considering starting to produce fried chips. The quality of the finished product is highly dependent on having good quality, clean oil.

Sun-dried banana chips

Sun-dried banana chips are a popular snack food. They are made by drying the banana pieces on trays under the sun. A solar dryer or cabinet dryer can be used if available – both these interventions will produce higher quality banana chips. See the Practical Action technical briefs on drying for further information on the practicalities of drying at the small scale.

Equipment needed

- Knives or small fruit slicer
- Plastic buckets or bowls for soaking fruit
- Plastic sieve for draining the soak water
- Drying trays (solar drying)
- Drying cabinet (for assisted drying)
- Polythene bags
- Bag sealer

Selection and preparation of raw material

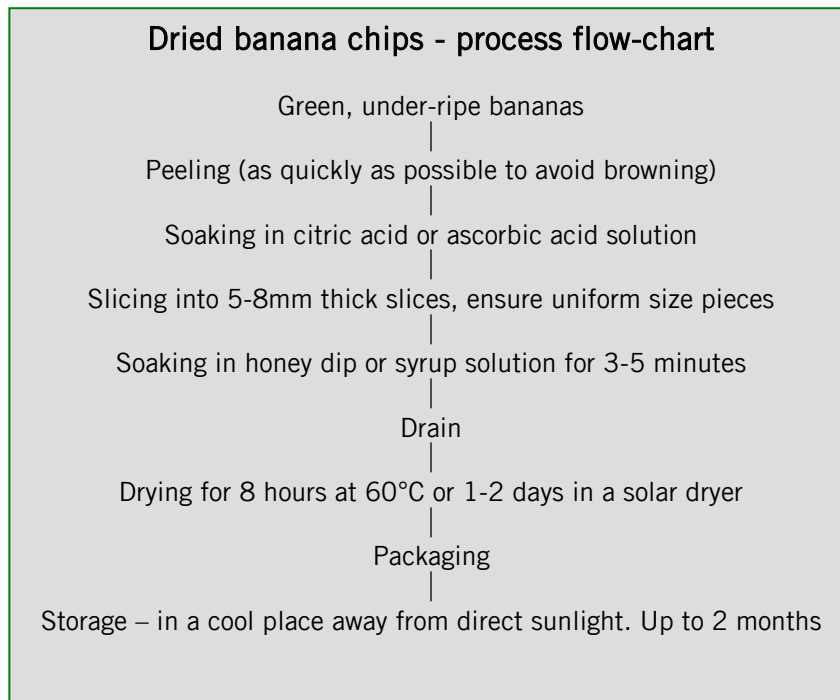
The selection and preparation of raw material is the same as for fried bananas above.

Drying

After soaking the banana slices in honey, syrup or fruit juice dip, drain the pieces well and place on the drying tray. If you do not want to soak the pieces prior to drying, it is possible to paint with a honey solution once the slices are laid on the drying trays.

Place the pieces as close together as possible on the drying trays to ensure the maximum drying capacity. The pieces must not be touching or overlapping each other. If drying outside in the sun, cover the tray with a piece of muslin cloth to protect from insects and dust. Place in the drying position or into the solar dryer. If you are using a cabinet dryer, dry the pieces at 60°C. Leave the pieces in the dryer until they are crispy and dry – the length of time taken will vary

according to the type of dryer used, the climate and the level of humidity. Do not dry too quickly or the pieces may dry on the outside before the middles are fully dry. Remember that the banana slices will discolour during drying. To maintain a good bright colour, the drying process should be as short as possible.



After drying, cool to room temperature and package in moisture-proof packaging. Label and store in a cool place away from direct sunlight.

References and further reading

[Drying of Foods](#) Practical Action Technical Brief

[Small-scale Drying Technologies](#) Practical Action Technical Brief

[Banana Beer](#) Practical Action Technical Brief

[Adding Value to Bananas](#) Food Chain 21, July 1997, Practical Action

[Traditional Foods: Processing for Profit](#) by P. Fellows, Practical Action Publishing, 1997

Practical Action Bangladesh has produced a booklet on green banana chips production in Bangla.

This document was produced by Dr. S Azam Ali for Practical Action in March 2008. Dr. S Azam-Ali is a consultant in food processing and nutrition with over 15 years experience of working with small-scale processors in developing countries.

Practical Action

The Schumacher Centre
 Bourton-on-Dunsmore
 Rugby, Warwickshire, CV23 9QZ
 United Kingdom
 Tel: +44 (0)1926 634400
 Fax: +44 (0)1926 634401
 E-mail: infoserv@practicalaction.org.uk
 Website: <http://practicalaction.org/practicalanswers/>

Practical Action is a development charity with a difference. We know the simplest ideas can have the most profound, life-changing effect on poor people across the world. For over 40 years, we have been working closely with some of the world's poorest people - using simple technology to fight poverty and transform their lives for the better. We currently work in 15 countries in Africa, South Asia and Latin America.