

Coconut chips : A healthy non-fried snack food

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Coconut chips are crunchy, delicious nutritionally rich chips prepared out of 8-9 months matured coconut kernels. The kernels are uniformly sliced into about 0.75mm thickness and osmotically dehydrated with either salt water or sugar syrup. They do not require continuous deep oil frying as other chips.

Why we need alternate snack foods?

Many of the widely consumed snack foods are high in refined carbohydrates or added sugar and low in nutritional value. Non-diet soft drinks, cookies, candy, pastries, granola bars, chips, pretzels and crackers generally contain more calories and are less satiating than fruits, vegetables, whole grains, nuts and seeds. Consuming too many refined or sugar-rich foods

can cause high blood triglyceride levels while decreasing levels of health-promoting HDL cholesterol and may contribute to inflammation and oxidative stress, according to the American Heart Association.

Researchers in Europe and the United States have found acrylamide in certain foods that were heated to a temperature above 120°C, but not in foods prepared below this temperature. Potato chips and French fries were found to contain 39 to 910 times higher levels of acrylamide compared with other foods. The World Health Organization and the Food and Agriculture Organization of the United Nations stated that the levels of acrylamide in foods pose a “major concern”. Hence, there is an urge to search alternative health promoting snack foods which is devoid of frying. One possible health promoting source of snack

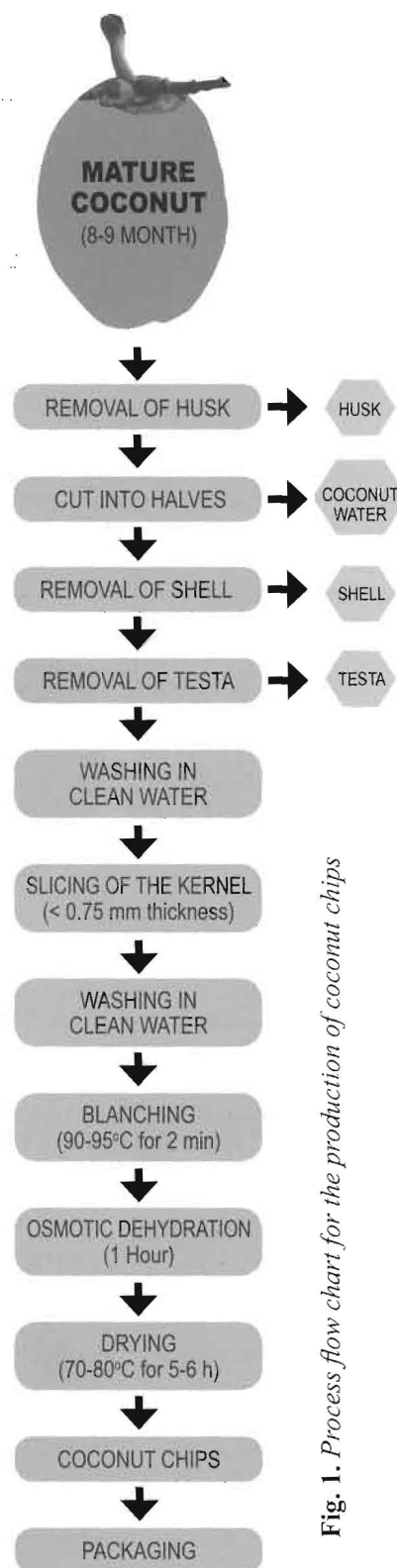


Fig. 1. Process flow chart for the production of coconut chips

food is coconut chips which don't require deep frying

What makes coconut chips as a healthy alternate snack food?

Coconut has been part of diet and livelihoods in the tropical countries of Asia, the Pacific, South and Central America and Africa for thousands of years. It provides a nutritious source of kernel, water, milk, and oil that has fed and nourished populations around the world for generations. Coconut kernel is a potent source of carbohydrate and rich source of plant protein with appreciable amount of fiber. It is naturally low in digestible carbohydrate, contains no gluten, cheaper than most other nut flours, loaded with health promoting fiber and important nutrients with good taste.

How to prepare?

Coconut kernels undergo paring, blanching, osmotic dehydration and drying to become ready to eat chips. Frying is not undertaken in coconut chips making process. Using a new method of drying on the basis of osmosis, in which partial dehydration in sliced form is brought about by dipping the fresh kernel in sugar solution followed by hot air drying. This is claimed to result in product with better flavor than freeze drying method at comparatively lesser cost. Hence, the resultant coconut chips give health promoting substances and do not pose any health hazard. Nutritionally superior and medicated coconut chips can also be made by incorporating beet root, carrot, ginger and pepper. Central Plantation Crops Research Institute (CPCRI), a constituent of Indian Council of Agricultural Research (ICAR) and only coconut based research institution, has successfully developed a process protocol and machineries for the production of coconut chips. The CPCRI has already provided training to large

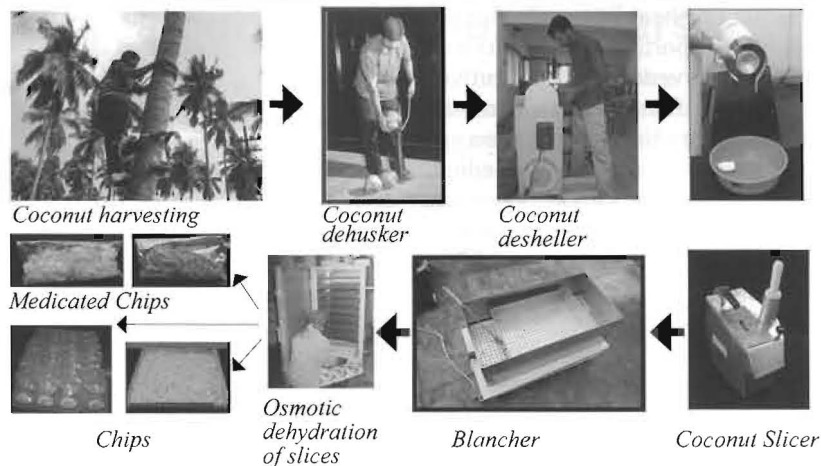


Fig. 2. Process protocol developed for production of coconut chips

number of women entrepreneurs and self help groups in coconut chips making. A few units have started commercial production and there is a good demand for this product in the domestic and international market.

Process Technology

Freshly harvested 8-9 months old coconut is selected for chips production. The index for selection of the nut is that the nut should be matured enough to be sliced. If it is too tender, slicing and testa removing is not possible. The husk is removed from coconut by manual or mechanical dehusker. The shell is removed by using chisel type tool or shell removing machine. Testa, brown outer layer of coconut kernel is removed by using manual peeler or coconut testa remover. Testa removed coconut is washed in clean water. White kernel is cut into pieces of triangular shape of about three inch size to hold it by hand for easy slicing of the kernel. The slicing of kernel is undertaken in either manual or mechanical slicer. The thickness of the slice should be very thin and should not exceed 0.75 mm. Thoroughly washed coconut slices are put in muslin cloth for blanching and dipped in hot water at 90-95°C for 2 minutes to arrest enzyme activity.

After blanching, the coconut slices are dipped in the osmotic medium for osmotic dehydration for one hour. The osmotic medium differs according to the type of chips. The temperature of the medium should be at room temperature. For the small-scale industry, agitation of the syrup during osmotic dehydration is not required. For large-scale industry, agitation of the syrup during osmotic dehydration is required. The syrup may be stirred every 10-15 minutes.

For the production of sweet coconut chips, 600 g coconut slices are dipped in osmotic medium syrup containing 1 kg cane sugar of commercial grade and 20 g common salt in one litre clean water for one hour. This medium can be reused with the addition of 150 g sugar and 5 g salt for every 600 g coconut slices. Different flavours like vanilla, pineapple, lemon and orange can also be added at 10 ml per litre syrup. For the preparation of medicated chips, ginger essence obtained from 150 g ginger is added along with the normal ingredients. Nutraceutical coconut chips can also be prepared by adding the juice obtained from 600g carrot/beetroot or coconut inflorescence sap (Neera/Kalparasa) with the usual ingredients. By giving natural colour to the sweetened

coconut chips, the nutritional quality in terms of phenolics, antioxidants, and other important nutrients as well as the attractiveness can be improved so that it can flourish in the domestic market. For the preparation of salted spicy chips, osmotic medium containing 30 g common salt in one litre clean water is used. Further, for every additional dipping of 600 g of slices, 10 g salt is added to the salt solution. After drying the slices, required quantity of chilli powder or black pepper powder or white pepper powder is sprinkled to get salted spicy coconut chips. Thus, the product diversification in coconut chips making will enhance the marketability and consumption of coconut chips.

Coconut slices after osmotic dehydration needs to be dried immediately. The slices are taken out from the sugar solution and allowed to drain. After draining out, the slices are spread in a thin layer on filter paper kept inside the trays of a dryer. Solar, electrical, biogas/LPG and biomass fired dryers are used for drying of coconut slices. The osmotic dehydrated coconut slices can be dried in forced hot air electrical dryer at 70-80°C for 5-6 hours.

The coconut chips are hygroscopic in nature. If the relative humidity in the atmosphere is more than 75 percent, it will absorb moisture and lose its crispness. Hence the chips must be packed in the metallised poly film or aluminium foil laminated with LDPE film pouches, which will maintain its flavour and crispness up to six months period without affecting its microbial and biochemical qualities. To avoid the breakage of the chips during transportation, it may be packed as pillow packet using gases like nitrogen or carbon dioxide.

Important steps involved in the production of coconut chips are given in process flow chart (Fig.1).

The protocol and machineries required for the production of coconut

chips is given in the Figure 2.

The nutritional quality of the coconut chips is given in table 1.

Table 1. Nutritional quality of coconut chips

Property	Quantity
Moisture (%)	2.17
Total Fat (%)	48.10
Protein (%)	1.24
Total sugar (%)	39.35
Crude Fiber (%)	6.13
Ash (%)	1.36
Total carbohydrate (%)	46.13
Energy (Cal per 100 g)	622

Major part of the fat contains medium chain fatty acids such as lauric acid and capric acid which are beneficial for human health and nutrition. Lauric acid has the additional beneficial function of being formed into monolaurin in the human or animal body. Monolaurin is the antiviral, antibacterial, and antiprotozoal monoglyceride used by the human or animal. Further, it helps in reducing harmful LDL and total cholesterol and increasing beneficial HDL in human body.

Economic analysis of coconut chips processing

For any entrepreneurship venture, economic analysis needs to be undertaken. ICAR-CPCRJ has standardised the process protocol, developed the machineries for processing 250 coconuts per day for coconut chips production and transferred this technology to the aspiring entrepreneurs at nominal technology transfer fee of Rs. 10000. The economic analysis comprised the estimation of fixed cost, variable cost, production cost, profitability projection and break even period for processing of 250 coconuts per day for a period of 300 days in a year. The fixed cost includes manpower, interest on capital loan and working capital, depreciation on machinery and building, administrative

expenses, insurance and sales promotion expenses. The variable cost includes the working capital, expenses on electricity, water and other utilities. The expenditure on raw material and packaging material is taken into account under working capital. During coconut chips production from 75000 coconuts / year, 30000 kg husk, 10000 kg shell, 7500 litres water, and 500 kg testa are obtained.

The additional benefit of selling these co-products is not accounted in this analysis. The coconut chips processing unit shall be located in the vicinity of the coconut growing area to ensure the continuous supply of raw material "coconut". Approximately 2000 square feet land which includes 1000 square feet building area is required. The cost of machineries and equipments for coconut chips production is estimated at 6 lakhs. One supervisor and two skilled labours are required for operation and maintenance of coconut chips unit. Using the above assumptions, the total fixed cost is estimated at 12.06 lakhs. The total variable cost is estimated at 26 lakhs. The unit cost of production is estimated as 8.45 per 25 g packet of coconut chips.

By processing 75,000 nuts / year, entrepreneur can produce 11250 kg coconut chips. By selling coconut chips at the rate of 800/kg, entrepreneur can get a net profit (per year) of Rs. 51,93,500. Additionally by selling the co-products like coconut husk, shell, testa and water, entrepreneur can earn more income. It is concluded that after producing 84832 packets of 25g coconut chips, no profit no loss point will occur after 56 days of functioning of the unit. Thus, coconuts chips based venture can contribute modest increase in the income and livelihood of the entrepreneur. Apart from the profitability, this venture can result into a suitable healthy snack food for children and adults. ■