quinoa

a zine for the international
quinoa research symposium

This zine was created for the 2nd International Quinoa Research Symposium, an online event presented August 17-19, 2020 by the WSU Sustainable Seed Systems Lab in collaboration with the WSU Food Systems Program to focus world attention on the role that quinoa's biodiversity, adaptability, and nutritional value plays in providing food security, seed sovereignty, sustainable production and holistic use worldwide. For more info visit quinoasymposium.com.

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quinoa

information, inspiration, and recipes

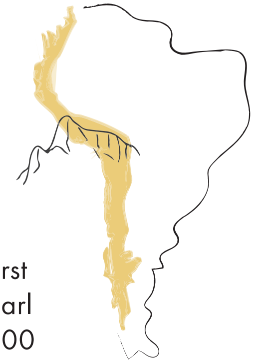
Introduction to Quinoa

Quinoa is a nutrient rich food crop with edible seeds and leaves. This increasingly popular ingredient in modern cuisine has been under cultivation in South America for over 8,000 years. Quinoa's rich cultural history began as a South American ceremonial and ritually-significant indigenous food that subsequently endured targeted extinction and recent resurgences. Although extinction events caused losses in genetic diversity, the quinoa of today displays a mesmerizing range of colors, flavors, and textures. Such qualities of quinoa provide a wide palette for foodies, tastemakers, and chefs to work with. Quinoa is frequently served as a whole grain, but it is also a tender leafy green and the seeds are used as an ingredient in noodles, bread, confectionaries, and alcoholic beverages. Quinoa is widely known for its nutritional benefits - for example, it is an excellent source of essential amino acids and protein. Researchers continue to uncover additional ways in which quinoa contributes to a healthy diet, such as some varieties being high in antioxidants and minerals.

This zine showcases quinoa's culinary attributes and encourages eaters to incorporate this ancient and nutritious food into their diets. Recipes have been thoughtfully crafted and presented by Chilean quinoa experts, chef Sebastián Tobar Bächler and scientist Dr. Francisco Fuentes Carmona. This publication is being released as part of the 2nd International Quinoa Research Symposium hosted by Washington State University's (WSU) Sustainable Seed Systems Lab in collaboration with the WSU Food Systems Program. The Sustainable Seed Systems Lab seeks to support and advance agrobiodiversity with the research of grains and pseudocereals in the fields of plant breeding, crop science, and soil science. The WSU Food Systems Program is a Cooperative Extension program dedicated to providing resources for Washington State's farmers and food systems contributors with a focus on improving access to healthy food.

In a melding of these two missions, this symposium and zine aim to highlight the role that quinoa's biodiversity, adaptability, and nutritional value plays in providing food security, seed sovereignty, sustainable production and holistic use worldwide. Join us in our efforts - eat quinoa! We hope you enjoy experimenting with this unique food crop.

Origin & History



Quinoa, a tetraploid crop plant, was described for the first time in 1797 by the German botanist and pharmacist Carl Ludwig Willdenow. It has been cultivated for the past 8,000 years in the South American Andes. It is hypothesized that the closest ancestors of quinoa could be the species *Chenopodium berlandieri* var. *nuttalliae*, distributed in North America, or a complex of species growing in the southern hemisphere, including *Chenopodium pallidicaule, Chenopodium petiolare, Chenopodium carnasolum*, and the tetraploïd species, *Chenopodium hircinum* or *Chenopodium quinoa* var. *melanospermum*. All these species are from the Andes. The areas cultivated with quinoa in South America goes from 2º North latitude in Colombia to 47º South latitude in Chile, and from 4,000 m in the high Andes to the sea level in southern latitudes. Particular adaptations of this species to certain geographical areas along the Andes gave rise to five major ecotypes associated with subcenters of diversity, differing in branching morphology and adaptations to rainfall regimes with precipitation ranging from 2000mm per year to strong drought stress of 150 mm per year. These ecotypes are the (i) Inter Andean valleys quinoa (in Colombia, Ecuador, and Peru); (ii) Highlands quinoa (in Peru and Bolivia); (iii) Yungas quinoa (in Bolivian subtropical forest); (iv) "Salares" quinoa in salt flats (in Bolivia, northern Chile, and Argentina); and (v) Coastal quinoa, from lowlands or sea level (in central and southern Chile). The quinoa landraces had also adapted to different soils, climates, and particularly day-lengths as day-lengths grow longer in the spring and summer seasons toward the southern latitudes.

Domestication

Quinoa (*Chenopodium quinoa*) has been cultivated for thousands of years along the Andean cordillera of western South America from Colombia to Chile. Cultivated quinoa is a product of human ingenuity, domesticated by indigenous societies approximately 7,000 years ago from a wild *Chenopodium* species by selecting for traits that facilitate cultivation and consumption. Physical traits such as larger seed sizes, thinner seed coats, seeds that tightly adhere to the plant, and more uniform maturation differentiate domesticated quinoa from its wild progenitors. Genetic and archaeological evidence strongly suggests that the South American *Chenopodium hircinum* is the progenitor species to quinoa and that quinoa was domesticated twice, once in the Andean highlands near Lake Titicaca and a second independent domestication in coastal Chile. After domestication, quinoa spread across the Andean region and differentiated into ecotypes and hundreds of unique varieties as farmers and end-users selected those suited to their preferences and environments. Quinoa is one of several *Chenopodiums* that have been domesticated, other examples include Huazuontle (*Chenopodium berlandieri* ssp. *nuttalie*) in Mexico and Djulis (*Chenopodium formosanum*) in Taiwan.

Ancestral Knowledge

Quinoa has recently gained worldwide importance due to its nutritional benefits. The nutritional value of its grains has been widely recognized for their high-quality protein (particularly rich in essential amino acids) and for their carbohydrate, oil, mineral and vitamin content. Quinoa is also considered a good source of dietary fiber and other bioactive compounds, such as polyphenols and triterpenoids. Thus, natural compounds traditionally adopted in the prevention and treatment of a range of pathologies have recently received much attention for the antioxidant and anti-inflammatory nature of their components, either separately or combined.

Considered as a whole, the scientific reports support quinoa's potential as a food supplement capable of enriching a normal diet by providing sources of natural compounds with antioxidant properties. Likewise, quinoa grain has traditionally been used by the Andean people as a natural remedy in the antiinflammatory treatment of muscle sprains, twists and muscular strains, placing poultices made from quinoa grains (especially the "black" type) mixed with alcohol on the affected zones. Traditional knowledge also suggest that eating quinoa promotes lactation. Quinoa, therefore, offers great potential for use in complementary and alternative medicine on the basis of its traditional knowledge. With the emergence of new technologies in the area of chemical research, molecular biology and pharmacology, the use of quinoa as a nutraceutical agent is increasingly gaining recognition.

Botany

Quinoa (*Chenopodium quinoa* Willd.) is a dicotyledonous allotetraploid (two sets of chromosomes derived from two different ancestral species, 2n=4x=36) Andean seed crop. The cultivated plant typically reaches 1.25 to 2.5 meters in height, depending on the variety and environmental conditions. Quinoa has broad, variably lobed, alternately arranged leaves that range from lanceolate (which refers to a leaf with a narrow oval shape tapering to a point at each end) to triangular and originate either from branches or from a central stem. The leaves are very similar to spinach leaves. The stem and leaves can exhibit various eye-catching shades of red, maroon, green, and purple.

Quinoa flowers form clustered panicles at the top of the plant, and, in many varieties, also from leaf axils along the main stem. Flowers grow either from a secondary axis (called amaranthiform) or a tertiary axis (designated glomeruliform). The flowers are predominantly self-fertilizing, though wind and insect-mediated cross-pollination frequently occurs in 10-15% of the flowers, thereby providing a constant supply of novel genetic combinations which facilitates relatively rapid adaptation to changing environmental conditions. Perfect (male + female) flower forms commonly occur on the distal end of the glomeruli (a dense, compact cluster of flowers) and contain five anthers clustered around a superior ovary. Pistillate (female) flowers are also common at the proximal end of the glomeruli.

Quinoa seeds are actually disk-shaped achenes (a simple dry fruit produced in many species of flowering plants) about 2 mm in diameter and 0.5 mm in thickness. Depending on the cultivar, striking variation in seed color is found, ranging from white, gray, and yellow to red, brown and black.

Exploring the Diversity of Quinoa

No matter how you look at the different types of quinoa, there is a striking amount of diversity to explore.

SWEET VS. BITTER

One of the main differences in types of quinoa is between those that are "sweet" and those that are "bitter." The types we think of as "sweet" lack certain compounds on the seeds that result in the bitter taste found in other types. Removing these compounds before eating via washing or abrasion gets rid of this bitter taste.

DIVERSITY THROUGH DOMESTICATION

Quinoa exists on a spectrum. On one end of the spectrum are "weedy" types that resemble the wild relatives from which indigenous peoples domesticated quinoa. On the other end of the spectrum are types developed to grow well with intensive application of fertilizer and irrigation.

MORE COLORS THAN YOU IMAGINED

Quinoa plants and seeds come in a rainbow of colors. Most people are familiar with the primary seed colors: white, red and black. However, many other colors of quinoa exist, including green, cream, yellow, golden yellow, pink, orange, varying shades of coffee, purple, and gray.

MORE USES THAN YOU MIGHT HAVE TRIED

Boiled quinoa eaten like a grain is the form many people are most familiar with. But there are many different culinary and baking uses for quinoa around the world. Quinoa can be toasted, flaked, malted, sprouted, milled, and extruded to make myriad food products. In fact, certain types of quinoa are best suited to each of these applications. Washington State University researchers analyzed 28 varieties and proposed groups based on use in either baked goods, Asian noodles, thickening agents, or pasta products.

Terminology

CHENOPODIUM QUINOA

The latin name for quinoa where *Chenopodium* is the genus and quinoa is the species. The *Chenopodium* genus is popularly referred to as goosefoots and belongs to the Amaranthaceae family, which includes familiar plants like spinach, beet, and chard and others, like epazote.

SAPONIN

Bitter types of quinoa contain saponins, a diverse group of compounds that produce a foam when mixed with water. They are unpalatable and must be removed from the seed coat during processing. Saponins can be removed by washing or abrading the seed. Sweet types of quinoa contain few to no saponins and require less processing. Most quinoa seed sold in grocery stores has already been processed to remove saponins and is ready to cook when you get home.

HALOPHYTE

Halophytes are plants that can tolerate high levels of salt in the soil. The term is derived from the Greek halas (salt) and phyte (plant). Quinoa can tolerate salty soils better than many other crop plants. Even still, some quinoa cultivars are more salt tolerant than others. Highly salt tolerant quinoa cultivars could be important to food security in areas with saline soils and limited fresh water for irrigation.

ESSENTIAL AMINO ACID

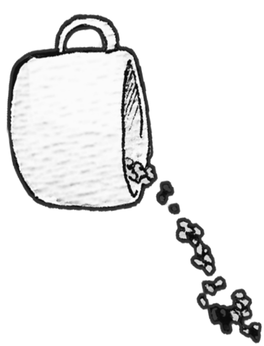
Essential amino acids are critical to normal bodily function but cannot be synthesized by humans. These nine amino acids (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine) must be consumed in the diet. Quinoa is valued for having high quality seed protein that provides a rich source of essential amino acids. The crop is of particular interest for global food security because it is high in lysine, which is often lacking in cereal grains such as maize and wheat.

Culinary Usage and Nutritional Information

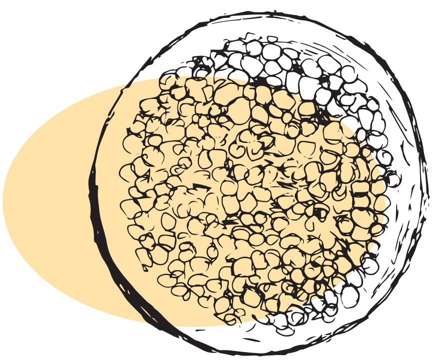
Various studies have reported the nutritional composition of quinoa, highlighting in particular the biological value of its grains: protein concentration; starch and dietary fibre content – around 60% and 13%, respectively; and oil content of 4.5–8.7% in the following proportions: 24% oleic, 54% linoleic and 4% α-linoleic. Quinoa is also considered a good source of riboflavin, thiamine, folic acid and both α and γ-tocopherols. In comparison with other grains, it has high concentrations of calcium, phosphorus, magnesium, iron, zinc, potassium and copper. In addition, significant quantities of bioactive components, such as phytosterols, betaines, squalene, ecdysteroids, fagopyritols, carotenoids, vitamin C and polyphenols (e.g. kaempferol and quercetin), have been identified in its grains, which have been widely reported as having beneficial health effects.

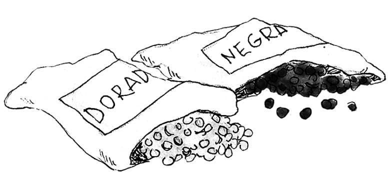
The leaves of quinoa contain a considerable quantity of ash (3.3%), fibre (1.9%), nitrates (0.4%), vitamin E (2.9 mg α TE/100 g), sodium (289 mg/100 g), vitamin C (1.2–2.3 g/kg) and proteins (27–30 g/kg). Quinoa leaves, like its grains, also contain a large quantity of bioactive compounds, such as ferulic, sinapinic and gallic acid; kaempferol, isorhamnetin and rutine. Nevertheless, a number of so-called "anti-nutritional" elements have also been reported in its grains, including tannins, protease inhibitors, phytic acid and saponins.

The main shortcoming of quinoa is, therefore, the bitter taste of its grains, resulting from the saponins which are present in the external seed layers and have been widely described as an anti-nutrient due to their strong binding affinity to minerals. However, there is increasing evidence that saponins can have beneficial health effects (e.g. anticarcinogenic and hypocholesterolemic effects).



Recipes





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MULTI-COLORED QUINOA SALAD

- 40 grams red pepper (2 Tbsp)
- 40 grams purple onion (2 ounces)
- 10 grams chives (1 Tbsp)
- 40 grams cucumber (2 ounces)
- 40 grams mushrooms (2 ounces)
- 10 cc olive oil (1 Tbsp)
- 10 cc apple cider vinegar (1 Tbsp)
- 20 grams golden quinoa (1 ounce)
- 20 grams black quinoa (1 ounce)
- Salt and pepper to taste

Cook the quinoa separately in simmering water for about 15 minutes. Strain to remove any remaining water. Allow to cool.

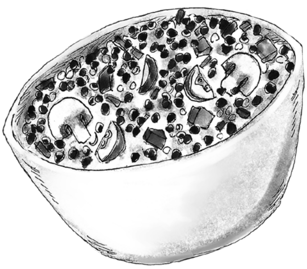
Chop all the vegetables into small cubes and finely chop the chives.

In a large bowl, mix all the vegetables with the cooked quinoa.

Add the oil, vinegar and salt.

Add pepper and season to taste.

Serve in a deep plate.



LIMA BEAN CROQUETTES with QUINOA LEAVES

Croquettes

- 100 grams lima beans (4 ounces)
- 5 grams green chili (1 Tbsp)
- 10 grams red pepper (2 Tbsp)
- 30 grams onion (2 ounces)
- 20 cc vegetable broth (2 Tbsp)

Rice:

- 50 grams brown rice (3 ounces)
- 30 grams carrot (2 ounces)
- 20 grams onion (1 ounce)
- 30 grams quinoa leaves (2 ounces)
- 30 cc olive oil (2 Tbsp)
- Salt and pepper

Cover the lima beans in water and soak the beans overnight.

Peel the beans and grind in a food processor along with the vegetable broth.

Finely chop all vegetables.

Add the peppers, onion and chili to the ground beans.

Season with salt and pepper.

Form small patties with your hands.

Cook in a pan with a bit of oil over low heat, until browned on both sides.

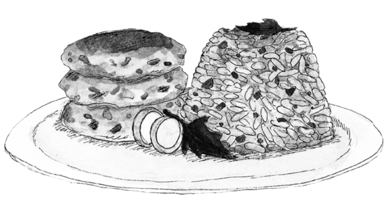
In a frying pan, sautee the carrot and onion briefly. Add the dry rice and brown lightly.

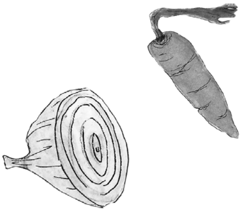
Season with salt and pepper.

Add boiling water and cook over low heat, adding more water as necessary, until cooked to the desired doneness.

Once the rice is cooked, turn it off and mix together with finely chopped quinoa leaves.

Serve the croquettes on top of a plate of rice.





QUINOTO with FISH WRAPPED IN CASHEW BUTTER & SPINACH

- 10 cc olive oil (1 tsp)
- 20 grams golden quinoa (1 ounce)
- 20 grams black quinoa (1 ounce)
- 20 grams Parmesan cheese (1 ounce)
- 40 grams purple onion (2 ounces)
- 10 grams chives (1/2 ounce)
- 40 grams red pepper (2 ounces)
- 40 grams mushrooms (2 ounces)
- 40 grams carrot (2 ounces)
- 20 grams butter (1 ounce)
- 20 grams cashew butter (1 ounce)
- 50 grams spinach (2 ounces)
- 300 grams white fish (10 ounces)
- Salt and pepper

Chop all vegetables into very small cubes.

Fry the vegetables in olive oil until browned. Add the quinoa. Add the vegetable broth as the quinoa dries out. Once the quinoa is cooked through, add the cheese and butter.

Let the mixture rest with the heat off. Mix vigorously and set aside.

Blanch the washed spinach quickly in boiling water and let cool on a chopping board.

Season the fish with salt and pepper then spread the cashew butter on the fish.

Place the fish on the spinach. Wrap very well.

Bake at 350ºF/180ºC until the spinach is golden brown.

To serve, place a bed of Quinoto on a plate and top with the fish.

PASTA with QUINOA LEAF PESTO

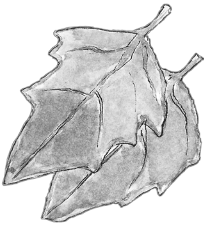
- 30 cc olive oil (2 Tbsp)
- 50 grams quinoa leaves (2 ounces)
- 50 grams Parmesan cheese (2 ounces)
- 20 grams parsley (1 ounce)
- 30 grams peeled almonds (1.5 ounce)
- 5 grams garlic (1 Tbsp)
- 50 grams fettuccine (3 ounces)

Place olive oil, quinoa leaves, parmesan, parsley, almonds, and garlic in a processor and blend well into a pesto.

Cook the fettuccine well covered in boiling water and salt until it is al dente.

In a pan, place the pesto and cook it for 2 minutes, then add the cooked fettuccine.

Serve in bowl and sprinkle parmesan cheese to taste.



SALMON PESTO PACKETS with QUINOA FLAN

- 250 grams salmon (9 ounces)
- 20 grams carrot (1 ounce)
- 20 grams summer squash (1 ounce)
- 50 grams mushrooms (2 ounces)
- 20 grams red pepper (1 ounce)
- 30 grams peeled almonds (2 ounces)
- 20 grams parsley (1 ounce)
- 5 grams garlic (1 tsp)
- 50 grams quinoa leaves (2 ounces)
- 30 cc olive oil (2 Tbsp)
- Salt and pepper

Flan:

- 1 egg
- 1 tablespoon heavy cream
- 1 tablespoon onion
- 1 cup cooked quinoa

Chop all the vegetables in julienne (thin strips)

Sauté the vegetables gently.

Place peeled almonds, parsley, quinoa leaves, garlic, olive oil, in a processor and pulse until well blended and comes together as a pesto.

Place the vegetables on the parchment paper and place a piece of skinless piece of salmon on top. Top with the pesto.

Wrap the food with paper to avoid the steam from escaping.

Bake at 350ºF / 180 ºC for 15 min.

Remove from the oven and serve wrapped.

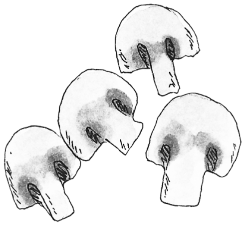
Flan:

In a large bowl, whisk the cooked quinoa with the cream and the egg.

Finely chop the onion and add it to the cream mixture.

Season to taste with salt and pepper.

Pour into individual molds or ramekins and bake at 350ºF / 180 ºC for 25 minutes.



STUFFED SUMMER SQUASH ROLLS with GOAT CHEESE & QUINOA LEAF SALAD

- 200 grams squash (7 ounces)
- 40 grams quinoa leaves (2 ounces)
- 20 grams green leaves (lettuce, arugula, chervil, baby spinach, etc.) (2 ounces)
- 30 grams almonds (2 ounces)
- 40 cc olive oil (1/4 cup)
- 40 cc balsamic vinegar (1/4 cup)
- 150 grams goat cheese (5 ounces)
- Salt and pepper

Slice the squash in thin layers.

Season and cook in pan on medium heat until the squash loses firmness and is able to be rolled up.

In a bowl, add the goat cheese and the chopped herbs.

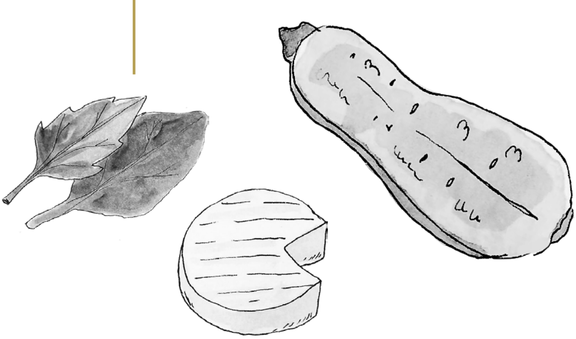
Add the chopped almonds, salt and pepper.

Add a teaspoon of the mixture at one end of the squash sheet and roll.

Wash all the leaves very well.

In a bowl, place a bed of the leaves and put the squash rolls on top.

Season with olive oil and balsamic vinegar.



CORN FLOUR & QUINOA LEAF POWDER AREPAS

- 240 grams corn flour (8 ounces)
- 1 tablespoon of quinoa leaf powder
- Pinch of salt
- 500 cc water (2.5 cups)

Place water in a bowl and add the corn flour. Let it hydrate for a few minutes.

Add the quinoa leaf powder and salt and mix

Shape the arepas with your hands, as if making bread, but thinner.

Place in a nonstick skillet and cook until browned.

Choose a stuffing of your choice for serving the arepas.

QUINOA WAFFLES

- 400 grams quinoa flour (14 ounces)
- 80 grams sugar (8 ounces)
- 8 grams baking powder (1 tsp)
- 400 cc milk (2 cups)
- 2 eggs
- 40 grams butter (8 ounces)
- 5 cc vanilla (1 teaspoon)
- 100 grams milk candy or caramel (3 ounces)
- 100 cc cream (3 ounces)

Beat the yolks and half the sugar until they are frothy and white.

Beat the whites with the rest of the sugar until stiff. Add the melted and cold butter to the yolks.

Add half of the milk.

Add the vanilla.

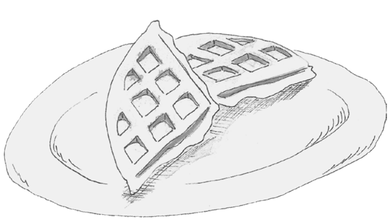
Gradually add flour and powders making sure there are no lumps.

Add the remaining milk, making sure the mix is not too liquid.

Finally, incorporate the whites in an enveloping way so as not to lose volume.

With a ladle, place the mixture over a waffle iron. Close the iron and let the waffles brown.

Serve with whipped cream and milk candy or caramel.



CREAMY COCOA QUINOA with MANGO CREAM

- 150 grams cooked quinoa (5 ounces)
- 200 grams mango pulp (7 ounces)
- 80 grams of butter (3 ounces)
- 70 grams cocoa or chocolate topping (2.5 ounces)
- 80 grams eggs (3 ounces)
- 60 grams yolks (2 ounces)

Cook the quinoa in plenty of water without salt.

Strain it and grind it in a blender with just a little cooking water until you get a homogeneous but thick mixture.

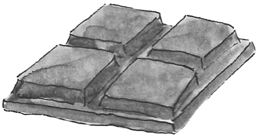
Melt the chocolate coating.Incorporate the chocolate or cocoa into the quinoa and mix well.

Put the mango together with the yolks and heat 160ºF / 70ºC on the stove. Let cool.

Warm the the quinoa-cocoa mixture and add the cubed butter until you get a creamy mixture. Let cool.

Assemble the quinoa in a bowl and place the mango mix on top.

Decorate with fresh fruit.



QUINOA FLOUR CHURROS

- 180 grams quinoa flour (7 ounces)
- 350 cc milk (2 cups)
- 25 grams butter (1 ounce)
- 20 grams sugar (1 Tbsp)
- 2 grams salt (1/2 tsp)
- Powdered sugar to sprinkle

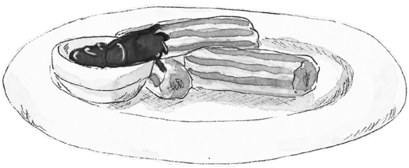
Boil the milk, butter, salt and sugar. (Milk can be substituted with water if desired)

Add the flour and mix to form a dough, being careful to make sure it doesn't stick to the bottom of the pot.

While still hot, put the dough into a pastry bag with a curly tip.

Pour into frying oil heated to 170 ºC. Fry for a few minutes, remove and drain on absorbent paper.

Sprinkle with powdered sugar.



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