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Chuño production derived from potatoes grown in the community of Pucará and its link with gastronomy

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— Abstract—

Chuño is an ancestral product obtained from potatoes undergoing a dehydration process, and it is a food that could potentially contribute to the gastronomical identity of an entire people group. The objective of this article is to report on studies focused on the production of chuño in the community of Pucará and its use within the local gastronomy. With this goal in mind, we worked with a qualitative approach and an ethnographic design to carry out the research. We employed direct observation and interviews along with bibliographic techniques to interpret and understand the diverse customs and traditions of this people group and the role of chuño in their gastronomy. The results of the study showed that the production of chuño is an essential activity within the Pucará community and the product is produced almost entirely for internal consumption within the community. It appears that chuño is not being used in as many gastronomical recipes as it could potentially be used in even though it has qualities that are useful in a whole variety of recipes, mainly as a replacement for corn or wheat flour. In conclusion, it appears that the community of Pucará is unaware of the great benefit chuño could add to their gastronomy and this negatively affects the production of this product. Due to this lack of knowledge, it could negatively influence future production of chuño and result in a disappearance of the product altogether meaning the community will not only lose the product but also its valuable biocultural heritage.

Keywords:

Cangahua; chuño; gastronomy; potato; production; cultivation.

According to Clavijo and Pérez (2014), peasant communities play a significant role in the domestication and preservation processes of various plant species through the observation, selection, exchange, and improvement of various products for human consumption. As a result, food production suitable for feeding, agriculture, sustainable development, and ecosystem services is obtained. In other words, the provision of food that manages to survive over time will be an important factor for the development of communities both in economic aspects and in food sovereignty (Swiderska *et al*., 2022), which is why the existence of agroecological models that are closely related to the sustainability of production, food consumption, and nutrition in the family are fundamental for the strengthening of a society and biocultural heritage (Franco-Crespo *et al*., 2021).

Faced with this position, both communities and society in general must ensure the existence of a diversity of plants and animals that adapt to various climatic conditions, pests, or diseases that ensure the lifestyle of people and the survival of communities considering that not all products are accessible to everyone and that not everyone knows the origin of all foods (FAO, 2019). In this sense, the importance of managing the traceability of certain products that ensure the origin, production, processing, and distribution of food until it reaches the final consumer will contribute to the progressive development of the communities that are dedicated to boosting their agricultural or livestock production (Ferreira & Rosado, 2019).

The potato, for example, is an Andean product that depends on several natural or artificial factors for its production, processing, and storage; which is why it becomes a perishable food that decomposes easily, so alternatives must be sought for its conservation for long periods (Perdigón *et al*., 2020). In that regard, an alternative preservation technique for potatoes is dehydration; an ancestral method carried out by several neighboring communities in South America to obtain a product called "chuño"; a food that can be stored and preserved for long seasons and sometimes for years (Ferrández *et al*., 2022).

Thanks to the physical and organoleptic characteristics that this product acquires, it can be used in various gastronomic preparations in both home and avant-garde kitchens. Its proper commercialization can significantly contribute to the traditions and customs of a people as well as to their food sovereignty (Devaux & Ordinola, 2021).

However, even though this type of product can contribute to the local economy, certain communities are dedicated to the process of transforming potatoes into chuño, such as the community of Pucará located in the parish of Cangahua in the province of Pichincha - Ecuador, where its commercial potential and its contribution to the biocultural heritage are devalued. The lack of knowledge about this product, its traceability, and its lack of existence throughout the year are limitations that do not favor its valuation.

The main objective of this work is to study the production of chuño in the community of Pucará and its intervention in local gastronomy; allowing, in this way, to generate new key information for three possible stakeholders on this type of product: the first, academia, through the development of updated data that can be useful in future research on potatoes and chuño; second, for society in general, who seek to understand and comprehend the importance of its production and consumption in a responsible way; and third, for those producers or traders, who seek to ensure the quality and safety of the product, labor, social and animal welfare, and the protection of human health and the environment.

To achieve this objective, this research considers its approach to the disciplinary structure in the field of Social Sciences regarding economics and anthropology, delimiting the latter to the place where chuño is cultivated, produced, and processed, as well as the representations and forms of consumption of a community around this product (Torres-Salcido & Saavedra, 2022). To this end, in the first instance, a global study on the general aspects of Ecuadorian agricultural production with emphasis on potatoes and their subsequent production in chuño is presented to consequently analyze the contribution of the community of Pucará and its link with the gastronomy around this product.

DEVELOPMENT

Ecuadorian agricultural production

Agricultural production is the result of the exploitation of the land to obtain goods, mainly, food such as cereals and various types of vegetables for social benefit (Colquehuanca & Blanco, 2021) and refers to everything related to all the various economic activities that have to do with agriculture such as: cultivation and soil treatment for food production, harvesting, distribution, and sales. Its contribution to new employment sources, especially for the rural sector, seeks to integrate responsible processes for production and consumption aimed at the well-being of producers and the conservation of the ecosystem (Prado *et al*., 2021).

Considering various agroecological and biocultural alternatives contribute to production, exploitation, and commercialization that play a part in a healthy diet and continuous sustainability (Franco-Crespo *et al*., 2021).

Faced with this scenario, studies such as those by Sánchez *et al*. (2020) or the National Institute of Statistics and Censuses - INEC (2019) state the existence in Ecuador of six important crops that occupy a greater extension in Ecuadorian soil such as sugar cane, banana, African palm, rice, potato, and corn, consider the importance of implementing various productive mechanisms

that contribute significantly to the development of food and communities where these types of products are valued for adequate consumption.

Just to give an example, potatoes, the object of study for this article, are cultivated in an area between 50 thousand and 66 thousand hectares and contribute a production between 300 thousand and 480 thousand metric tons per year (Institute of Statistics and Censuses – INEN- cited in Suquilanda, n.d.; Barrera *et al*., 2019) compared to an approximate production of 1,2 million tons of corn, in a crop of around 200 thousand hectares (Castillo 2018) or 1,4million tons of rice in 370 406 hectares (Zambrano *et al*., 2019), which are foods that are part of the daily diet of the Andean region in the main family kitchens.

In this regard, Andean tubers, such as potato, achira, white carrot, sweet potato, oxalis tuberosa, melloco, Chinese potato, and mashua, among others, are cultivated by various communities settled in different ecological zones between 2 800 and 3 500 meters above sea level, in Bolivia, Colombia, Ecuador, and Peru (Araujo *et al*., 2021) are a clear example of the great variety of foods that contribute to the food sovereignty of a people.

Potatoes

The potato, considered one of the main productive activities of the Andean region, (Institute of Statistics and Censuses – INEN- cited in Suquilanda, n.d.; Barrera *et al*., 2019), is a food that is part of the daily diet of families of the Ecuadorian highlands and is very useful in various traditional and daily gastronomic preparations. According to the studies of Araujo *et al*. (2021) and Beals (2019), this product is rich in carbohydrates, fiber, vitamins, and minerals, which can prevent cardiovascular or brain diseases, making it an important food in the human diet.

In Ecuador, potato cultivation has become one of the main productive activities of the Andean region and links a large number of actors that make up the productive, industrial, and commercial sectors. The largest amount of potato production and cultivation is distributed throughout the Ecuadorian highlands in rural areas that have adapted their soil to the productive development of this type of food.

Studies conducted by Mastrocola *et al*. (2016) stated that, of the 100% of potato production grown in Ecuador, 81% is consumed by the domestic fresh market and 19% is destined for the industry sector to be processed into fries, flakes, or strips. This contemplates a strong demand at the national level, with greater demand in the Andean region where consumption per person reaches approximately 24 to 30 kilos per year (Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), 2014).

An interesting fact in Ecuador is that there are about 400 native and improved varieties of potatoes, of which only 4% to 5% (approximately 17 to 20 varieties) are marketed (Pumisacho & Sherwood, 2002; Hidalgo, *et al*., 2011; Navarrete *et al*., 2022). Among some native potatoes that stand out commercially, some examples can be mentioned: Yema de Huevo, Bolona, Uvilla, Leona Negra, Leona Blanca, Pera, Coneja Negra or Coneja Blanca (Monteros *et al*., 2005, p. 13) and among the improved ones; the following stand out: Santa Catalina, María, Cecilia, Gabriela, Esperanza, Fripapa, Superchola (Torres *et al*., 2011; Tejada *et al*., 2016; Devaux *et al*., 2021).

In that sense, since there are so many varieties of potatoes on the market, they can be used gastronomically in various preparations. In this regard, if a variety of potato has an excess of water (like fripapa or super chola potatoes) it is because it has a lower solids content and can be used for frying in flakes or French fries and for salads (Araujo *et al*., 2021), but, if a variety of potato is sandy (for example, bolona, red pea, or uvilla potatoes) it is because it has a higher solids content and therefore they are more nutritious and give a special flavor to the preparations, being their use more recurrent in preparations such as locros or purées (Monteros *et al*., 2005).

Chuño or chuno

Chuño, chuno, or potato starch is a product that is often conceived of as this tuber for human consumption. It comes from the Quechua word "chuñu" as a result of the Indianism, that translated into Spanish means starch. This type of food is the result of freezing, drying, and squeezing certain types of potatoes during an ancestral process that lasts several days. That is, normally the potato previously selected for this process is exposed for several days to the weather for four or five days where at night, it freezes, and during the day, it thaws with the presence of the sun; in this first step, it is essential not to move the potato to maintain quality. Subsequently, at this time, we proceed to the manual squeezing stage that is normally stepped on with bare feet and heels; in this phase, all the liquid that the potato has is extracted. At the end, it is refrozen and thawed in the open air for another ten to fifteen days until it is completely dry. After this time, the shell is removed and stored (Mamani, 1978).

Another alternative traditional process that could last up to fifteen days in total is when the production of chuño is carried out by considering the cycles of freezing, sunbathing, and treading. That is, it first begins by spreading the tuber on the flat soil, which in turn is covered with straw or dry grass, to maintain the desired temperature; after this step, the temperature is changed according to the conditions provided by the sun itself;

finally, it culminates with the treading process to completely extract the water from the product and lengthen its life (Égüez, 2017).

In other words, the traditional chuño is characterized by being an ancient tuber dehydration technique that is carried out in several countries of southern America such as Ecuador, Peru, and Bolivia whose main objective is the conservation and storage for a long time of up to almost three years; which is why it has been constituted as the basis for the preparation of several gastronomic dishes that make up the family diet (Égüez, 2017).

Currently, the existence of different types of chuño is identified that depend on the ancestral process that is destined for its production. Black, for example, whose production process to obtain said characteristic color is carried out through sunlight through contact with air, which produces oxidation that causes it to vary to a brown or black tone, while another kind of chuño, also known as tunta or white, appears by a freezing process that takes place between the months of June-July where dehydration is carried out through the action of treading to extract all the remaining water and cooling when placed in the waters of the river or some lagoon at sunset in permeable plastic bags (Gianella, 2004).

Nutritionally speaking, chuño, having a large amount of starch and fiber, in addition to being an important source of iron and calcium, is a high-energy food compared to other foods of plant origin (Salgado, 2009; Callizaya, 2021).

In several countries of South America, such as Peru and the Bolivian highlands, chuño becomes part of traditional cuisine; an example of this is the particular case of Peru donating chuño, as it is a mechanism of preservation of the potato for many years, obtained by dehydration with the help of various elements such as salt, lime, casana, qoa, ishmuna, izaño, or bentonite (Le Cordon Bleu Peru, 2008), and it is used in various culinary preparations such as sauces, *marzamorras*, or cookies.

The Pucará community

The community of Pucará, belonging to the parish of Cangahua, is located in the Province of Pichincha, about 30 or 40 minutes from San Juan de Cangahua. It is an independent community made up of more than 200 families, with a population of around 2000 people. Its main economic activity is livestock and agriculture, and its livestock production is very limited due to the altitude and its climate. As for agriculture, they are mainly dedicated to the planting of potatoes, mellocos, wheat, and onions.

METHODOLOGY

To meet the proposed objective of studying the production of chuño in the community of Pucará and its contribution to local gastronomy was considered to carry out the research through the position of the qualitative approach where an ethnographic design was taken into account whose fundamental principle was inclined to observe various cultural practices that the different social groups considered as subjects of study. With this design, it was possible to interpret the various behaviors that are present in the customs and traditions of these people when describing, understanding, and explaining their social system around the production and consumption of chuño (Jesús Contreras & Medina, 2022). For this case study, the research axis focused on variables such as product traceability and contribution to food heritage from gastronomy.

According to Hernández *et al*. (2014), among the first steps to be taken in this type of ethnographic study is the formulation of the questions to be answered based on the proposed objective. In that sense, the following concerns were raised: 1) How is the production of potatoes in Pucará?, 2) How is the production of chuño in Pucará?, and 3) What is the contribution of chuño in the gastronomic field?

Subsequently, the information collection instruments that according to the latter authors may be useful and appropriate in this type of study were identified, considering techniques such as participant observation, field notes, interviews, or documents. Therefore, the information was collected during the second and third quarters of 2022 in two ways: the first, through the existing literature in various bibliographic sources from articles, institutional reports, and books that have been written about chuño; and the second, through two research methods: field observation and open interview carried out in situ between the various farmers and inhabitants of the same community of Pucará and the entrepreneurs of the food and beverage or gastronomic sector. For these last two techniques, some criteria or keywords were considered to gather information such as production and cultivation of potatoes, chuño, processing of chuño, ancestral knowledge around chuño and gastronomic contribution of chuño.

Once the necessary information was collected, its analysis was carried out using triangulation between the data obtained and the instruments considered (Sánchez *et al*., 2021).

RESULTS AND DISCUSSION

This section considers the results obtained that were previously surveyed and triangulated to interpret the cultural practices of the Pucará community concerning chuño.

1. Regarding the first question, how is the potato production in Pucará? the following information was obtained:

On an area of 33 237 hectares, over 3 200 meters above sea level, the parish of Cangahua has several communities that devote their efforts to various agricultural and livestock activities. Here the white onion, for example, occupies 4.51% of that area, alfalfa 0.69%, barley 0.39%, and potato 0.09% (Decentralized Autonomous Government of the Parish of Cangahua, 2014). Of the various communities in this parish, the community of Pucará is a place that is characterized by the production of several foods suitable for human consumption where the potato stands out. In this community, 58% of its population is dedicated to this crop, generating up to 30 quintals per family on average per season (Vivanco, 2015).

Within the community of Pucará, it is possible to identify the existence of some potato varieties that are grown in this area, such as Chola, Única, Capira, Leona, and Chaucha, which are destined for internal consumption of the community and which, sporadically, are sold in the same area or outside of it. There is also the existence of potatoes that are harvested at the last moment because they are considered very small, and are destined for the production of potato starch or chuno.

The study carried out in the community also showed the existence of some limitations in terms of the variety of food products that may exist in this area, which affects the nutrition of the population and social and economic development.

Another problem identified in this study, on this same topic, is the lack of knowledge that the inhabitants or farmers of this community have about how to build and generate a business model or brand image around food grown or produced in the area. In this sense, the highest percentage of family income, between approximately 60 to 70% comes from work activities related to construction, and a very low percentage from agriculture and livestock, especially milk production (J. Coyago, personal communication, September 10, 2022).

2. Regarding the second question, how is the production of chuño in Pucará? the following references were found:

Although in the community of Pucará it is known only as chuno and not as chuño, the production of this product has its origin since the beginning of the community. The traditional process carried out by all the inhabitants starts 1) initially with the fresh potatoes that were not considered for immediate consumption, or sale, the ones that were left aside or at the end of the harvest because they were very small in size, are selected to be transformed

into chuno. Then 2) it goes through a process where the tubers are washed and soaked overnight by repeating this process twice; then 3) they are ground in a mill manually until they are reduced to particles that improve the efficiency of the product in future preparations. 4) Then it is led to a sieving technique where a product very similar to a fine grit is obtained, usually called starch; the latter process can take up to three days to obtain chuno. 5) Subsequently, the product obtained is washed again and left to rest until the starch of the potato settles and is separated from the water. 6) After a day or so, the water is slowly removed until only the starch remains. 7) These last two steps are repeated twice to remove all impurities. 8) The last step is to dehydrate the starch for a few days in a cloth (white cloth) until it loses all its moisture to the environment during sunshine hours, and we get a product that is suitable for use in various gastronomic recipes (J. Coyago, personal communication, September 10, 2022). Finally, it is stored in plastic bowls or clay pots that do not have contact with moisture.

Although the process for obtaining chuño can vary from farmer to farmer, the production becomes part of the diet of the local inhabitants who see this food as a product that can save them from some setbacks. That is, in the face of a pest or drought, the production of chuño is used as a substitute food for the inhabitants.

A clear example of how the preventive storage of chuño helps society was during the pandemic caused by COVID-19, when several families had to modify their food consumption habits by not having enough economic income, or not being able to leave home, to get enough and varied products that contribute to an adequate diet.

For this reason, most families living in this community keep chuño in mind in their lives as a food source and do not see it as a product that can generate economic income inside or outside the community, due to two important factors: the first, because it has a long process for obtaining it, and second because people, potential customers or local markets, are unaware of the existence of this type of starch.

3. Regarding the last question, what is the contribution of the Pucará chuño in the gastronomic field? the following information was obtained:

The use of potatoes, from a gastronomic approach, is a product that is appreciated in traditional preparations such as locros or soups that are very characteristic of the town and the Andean region in Ecuador.

From the family kitchens of Cangahua, the chuno preparations that are mostly developed in this community are: a) the colada de chuno, which goes through a process of hydration of the starch in water and then is cooked until it thickens, obtaining a texture very similar to the gmachica, but in

this case with the starch of the potato; and b) The chuño tortilla, where the starch goes through a process of hydration, with the incorporation of sugar or salt and egg to then be cooked on the coals or in a frying pan. However, there are a few relevant preparations that are prepared sporadically ras: bread.

From the stoves of nearby restaurants located in different areas of the Cayambe canton, where specialists in the gastronomic area work, and who handle a modern avant-garde proposal, they do not use chuño within their recipes. This is because no source of production is dedicated to trade due to the long process needed to obtain it and therefore does not supply local establishments.

However, this can be very useful for making chuño tortillas, coladas, and desserts and as an emulsifying element for sauces or cooked doughs; this product is considered by this type of establishment as a substitute for other alternative products such as cassava starch or wheat flour (S. Imbago, personal communication, September 1, 2022).

As can be seen, chuño plays an important role in local cuisine both in salt preparations and in sweet elaborations related to confectionery, pastry, and bakery, which is perceived not only as one more ingredient of a recipe but because it links signs of culture, reflected in its domestication, and its use.

While chuño has been identified as a characteristic product of some gastronomic preparations, it is also an important element that benefits health favorably. That is, chuño is also considered an alternative and ancestral medicine to solve some diseases; this is thanks to its numerous medicinal properties and benefits as well as its nutritional components. In this sense, chuño is very useful for protecting the stomach, in cardiovascular diseases, as a food for diabetics, or for gargling to reduce the effect caused by the flu or discomfort by acting as an anti-inflammatory mechanism (Callizaya, 2021).

CONCLUSIONS

The method and type of study selected for this research made it possible to meet the objective proposed in this manuscript, which generated significant and useful information for several sectors; including academia, business, and agriculture, which allows us to understand the importance of chuño production, not only for a specific community but for various populations distributed throughout the Andean region of South America, where years of culture are linked and goes beyond an economic sphere.

In the particular case of the potato, within the community of Pucará, it was understood that, although there are varieties that are grown in this area such as chola, única, capira, leona, and chaucha that contribute favorably to the food security of this town, they do not necessarily cover all the needs of a locality. The low sustainable production and marketing of this product or chuño can harm the collective development of the community from a

domestication, nutritional, and economic point of view; the most likely causes for this problem are the misuse and exploitation of the land, where most of the time the cultivation and harvest lapses are not respected due to the lack of good agricultural practices, which do not allow the generation of products rich in vitamins and minerals that the market demands; and, the poor vision of some farmers when conceiving the cultivation of potatoes and the production of chuño only for internal consumption and not as part of a business model.

Specifically, from the field of domestication, actions aimed at maximizing the production of chuño must focus on conservation and genetic improvement, as well as on the research of this product and its varieties to enhance its value. It is concluded that, given the ideology of looking for alternatives to preserve various foods that may be useful over time, it has led to recovering ancestral techniques for the development of productive activities in the field and gastronomy, which have been adapted to the needs of the communities in these times and giving value to the culture of the inhabitants of a certain area.

From an economic point of view, it is concluded that chuño is a clear example of a product that can contribute income to a community. However, although it is very common to get chuño in the community of Pucará, it is only oriented as a food that is part of the diet of the local community members, so it does not have a very strong projection to be marketed. In this sense, the little interest that society gives to the existence and benefits of this food is overshadowed by the presence of other alternative products for gastronomic use such as corn starch or wheat flour.

As a general conclusion, we understand the usefulness of chuño as another ingredient that supports the preparation of some gastronomic recipes and as a substitute for other ingredients that support popular and avant-garde cuisine. That is to say, the representation that this product has within the gastronomy of the high-altitude villages (Andean communities) is valued through a culinary proposal that seeks to promote and highlight to the world the traditional gastronomy of a town as well as its natural and cultural resources from its Andean worldview. In this sense, ignoring that chuño production contributes significantly to community development and social benefit can cause a rapid loss of food-related biocultural heritage.

As a final reflection, this study highlights the importance of expanding and carrying out future research aimed at understanding or analyzing other very few studied Andean, coastal, or Amazonian foods such as the green banana, cassava, chonta, goose, melloco, chocho (tarwi), bean or quinoa, to mention a few examples, which still depend on ancestral techniques for their cultivation, processing or transformation process before finalizing their traceability as a food product where their contribution to local, regional, national, or international gastronomy is highlighted.

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