Universidad del Valle
Cuadernos de Administración

Journal of Management
Print ISSN: 0120-4645 / E-ISSN: 2256-5078 / Short name: cuad.adm.
Pages: 3-13 / Vol: 36 / Issue: 68 / Sep. - Dec. 2020
Faculty of Administration Sciences / Universidad del Valle / Cali - Colombia

Developing Boyacá's traditional soups as frozen, vacuum-packed products

Desarrollo de sopas típicas boyacenses empacadas al vacío y congeladas

[1] ***Sandra Patricia Cote Daza***
Professor, Program in Hotel and Tourism Administration, Faculty of Hotel and Tourism Administration
Fundación Universitaria Los Libertadores, Bogotá, Colombia. e-mail: spcoted@libertadores.edu.co

[2] ***Jesús Alexis Barón Chivara***
Professor, Program in Hotel and Tourism Administration, Faculty of Hotel and Tourism Administration
Fundación Universitaria Los Libertadores, Bogotá, Colombia. e-mail: jabaronc01@libertadores.edu.co

[3] ***Diana Cristina Moncayo Martínez***
Professor, Program in Hotel and Tourism Administration, Faculty of Hotel and Tourism Administration
Fundación Universitaria Los Libertadores, Bogotá, Colombia. e-mail: dcmoncayom@libertadores.edu.co

Article of Scientific and Technological Research
Submitted: 25/11/2019
Reviewed: 10/04/2020
Accepted: 26/06/2020
Thematic lines: Administration and Organizations
JEL classification: M11, M110
DOI: https://doi.org/10.25100/cdea.v36i68.8702

Abstract

Colombian tourism and gastronomy are flourishing, and the large variety of traditional dishes is capturing mainstream media attention worldwide. This, in turn, translates into an opportunity to promote the country's tourism; however, the traditional soups' supply is reduced due to the lack of preservation processes in gastronomic establishments to conserve these dishes. This research offers two traditional soups of the Department of Boyacá's gastronomy for frozen storage: *Cuchuco de Trigo con Espinazo de Cerdo* (wheat and pork soup) and *Sopa de Indios* (potatoes, cabbage, and cheesy dough soup). These products are developed to ease the dishes' handling in gastronomic establishments, thus enhancing the offer for tourists. The research methodology was developed through three phases: standardization and packaging, sensory analysis, and nutrient content setting. As a result, it was possible to standardize the cooking time of the *Cuchuco de Trigo con Espinazo de Cerdo* and *Sopa de Indios* to 110 and 105 minutes, respectively, and a shelf time of 30 days that provides a preservation process that boosts the gastronomic offer of Colombia's traditional dishes.

Keywords: Gastronomic tourism, Traditional food, Soup, Preservation.

[1] Food Engineer, Universidad de la Salle, Colombia, Master's Degree, Food Science and Hygiene, Universidad Nacional de La Plata, Argentina, Administrative and Accounting Economic Reflection Research Group, Category A Colciencias.

[2] Tourism and Hotel Administrator, Corporación Unificada Nacional (CUN), Colombia, Master's Degree, Business Administration and Direction, Universidad Pedagógica y Tecnológica de Colombia, Colombia, Administrative and Accounting Economic Reflection Research Group, Category A Colciencias.

[3] Chemical Engineer, Universidad Nacional de Colombia, Colombia, Master's Degree, Food Science and Technology, Universidad Nacional de Colombia, Colombia.

Resumen

El turismo y la gastronomía colombiana están en auge, la gran variedad de platos típicos se registra en diferentes medios de comunicación a nivel mundial. Esto se traduce en una oportunidad para fortalecer el turismo del país, sin embargo, la oferta de sopas típicas es reducida debido a la falta de procesos que permitan a los establecimientos gastronómicos conservarlas. Como objetivo de investigación se planteó ofrecer dos sopas típicas de la gastronomía del departamento de Boyacá, Cuchuco de Trigo con Espinazo de Cerdo y Sopa de Indios, para almacenar en congelación con el fin de facilitar el manejo de estos productos por parte de los establecimientos gastronómicos y así incrementar la oferta a los turistas. La metodología se desarrolló a partir de tres fases: estandarización y empaque, análisis sensorial y determinación del aporte nutricional. Como resultado del estudio se estandarizó el cuchuco de trigo con espinazo de cerdo y sopa de indios, con un tiempo de cocción de 110 y 105 minutos respectivamente, con una vida útil de 30 días, proporcionando un proceso de conservación que favorece la oferta gastronómica de los platos típicos del país.

Palabras clave: Turismo gastronómico, Alimentos típicos, Sopa, Conservación.

1. Introduction

The World Tourism Organization "has noted that gastronomy is one of the main factors that drive tourists to choose a destination. Despite this, gastronomic tourism's potential as an immaterial cultural heritage is yet to be harnessed" (Pololikashvili, 2018). A study conducted on global gastronomy shows that 87% of the participants consider gastronomy as a unique and strategic element to define the image and brand of their destination and geographical area. In Latin America, greater importance is given to gastronomy as a driver of tourism development (UNWTO, 2016). This highlights the role of regional food as unique elements of the product offered to tourists. In this sense, Di Clemente, Hernández and López (2014) sought to understand this phenomenon. They analyzed the traditional gastronomy of the autonomous community of Extremadura, noting that developing the traditional cuisine of a place is fundamental for the region's heritage, as it is a conduit of the identity and authenticity of a territory.

In the specific case of Colombia, the great variety of climates, regions and customs allows a varied gastronomic offer; however, different traditional dishes fall into oblivion, and their recovery allows returning to the culinary roots and encourages the development of agriculture. For their part, Llano and Carrillo (2015) conducted a study in which they explain how the recovery of regional cuisine is relevant to positioning the national gastronomic heritage through surveys and direct interventions to rescue the local cuisine.

The culinary customs are related to the preparation of soups. A wide variety of soups are consumed at different moments of the day and some even are an essential part of the festivities. Their preparation is a tradition in the country's regions, and they are related to the family sphere. The traditional dishes are described in multiple documents, such as Gran libro de la cocina colombiana1 by Chef Carlos Ordóñez Caicedo, which contains recipes, preparations, and ingredients.

The Colombian cuisine includes Boyacá's traditional dishes, whose main ingredients are potato and cereals such as corn. Dishes are served with pork, beef, and chicken. It is a high-calorie cuisine, considering the cold weather in most of the region; however, they blend perfectly, provide everything necessary for daily life, and use several byproducts, such as animal guts and leftovers from previous days, consumed as calentados (dish prepared with leftovers and rice). One could say that it is a heavy, pleasant, and substantial meal that always invites to have another dish (Vega and López, 2012). As part of their gastronomic offer, each municipality of Boyacá has traditional dishes representing their culture. For example, Tunja offers cuchuco de trigo con espinazo de cerdo (wheat soup with pork); Sáchica, creole hen; Aquitania, rainbow trout; Sotaquirá, sopa de indios (potatoes, cabbage, and cheesy dough soup); in Monguí, genovas (a type of sausage); and Ramiriquí and Sutamarchán, longaniza (a type of Spanish sausage). (MinCIT, n.d.).

Boyacá's traditional soups include cuchuco de trigo con espinazo de cerdo, a soup prepared with the output of the first milling of a cereal, usually mixed with chopped carrots, peas, broad beans, peeled and

[1] Great Book of Colombian Cuisine.

https://doi.org/10.25100/cdea.v36i68.8702

chopped potatoes, and beets (beta vulgaris); accompanied with pork backbone, hence its name. Sopa de indios is also consumed in the region. According to Ángel (2012), it is served during the Holy Week. Its ingredients vary between municipalities; for example, in the inclusion of ground beef and legumes in the dough.

Furthermore, Franco (2011) mentions that soup can be prepared from broths by adding fresh or dried pasta, semolina, starches, dietary fats, meat extracts, and protein hydrolysates. On the other hand, AINIA (2017) proposes that these products may be vacuum packed before receiving the heat pasteurization treatment and are ready for consumption, then called fifth-range foods. These foods arise due to the need to have easily accessible food with a short preparation time and are used around the world in traditional restaurants, institutions such as armed forces, schools, universities, prisons, hotels, fast food restaurants, and hospitals to standardize their products and refrigerate them to facilitate their daily activities.

Other industrialized soups are stored in a liquid state; however, these have technical difficulties, mainly related to sensory changes during the first days of storage. Salazar (2012) notes that these changes contrast with nutritional benefits. The water percentage of liquid soups exceeds 90% and are conducive to microbial spoilage, requiring the development of mechanisms to prevent and control the contact of certain microorganisms with the food.

The importance of having industrialized products, especially soups, is related to promoting these traditional dishes. Furthermore, it allows their commercialization and facilitates the logistics to take the products to the consumer, considering that these products' shelf life may exceed two months. Therefore, the industry has developed dehydrated soups to satisfy nutritional requirements and respond to this trend. However, dehydrated foods are prepared through industrial processes and later reconstituted with water and brought to heating temperatures (Brennan, Butters, and Burgos, 1998). This dehydration process changes the physicochemical characteristics of starches and leads to their gelatinization. This process changes the physical characteristics of soup, forming large starch granules and leading to the loss of solids, color and proteins; even the initial vitamin content of the product is reduced during industrialization and storage. Similarly, the studies by Kumpulainen, Sandell and Hopia (2018) have shown how the processed elements in these products cause product losses.

The techniques to develop industrialized soups involve several methods studied by several authors. Bonamino, Carreño and Cervilla (2009) developed instant soups and creams with quinoa flour. Córdova, Francisco and López (2006) developed a canned snail soup. This method is currently used in products sold in seasonal countries, where brands such as Campbell's (tomato soup), Amy's (organic soups), Castellana (Garlic soup), among others, are available on the market. There has also been research on traditional dishes, such as the Karshm soup from Armenian cuisine, applying experiments with H. transcaucasicum and Sotolon (Maimone, Manukyan, Tranchida, and Steinhaus, 2017), Korean fermented soybean paste soup, using taste tests for the consumer to evaluate the sensory properties (Kim, Kim, and Chung, 2019), and meat-based traditional Chinese soups, which identify the use of salt and its possible nutritional effects (Zhu, Zhao, Cui, Li, Yu, and Zhang, 2020). Hence, the research topic's relevance and the need to increase scientific research on traditional Colombian cuisine's industrialization.

In other studies, these preparations are analyzed as alternatives for industrialization and the use of new ingredients. In Peru, for example, Ramírez and Hinojosa (2016) developed a dehydrated soup based on the Hualhuas variety of quinoa (Chenopodium quinoa wild), skimmed powdered milk and spices. Traditional ingredients are also of interest due to their nutrient content and are researched to include them in various soups. In turn, García, Pacheco-Delahaye, Tovar, and Pérez (2007) standardized an arracacha flour used in instant soups with a 60% flour addition. Other research has sought to answer various issues, including the development of gluten-free instant soups and creams from quinoa seeds (Chenopodium quinoa

https://doi.org/10.25100/cdea.v36i68.8702

Wild) by Bonamino *et al.* (2009). Similarly, Velezvía (2005) developed a work to prepare reconstitutable soups based on carachi (Orestiasagassii V.), tarwi (Lupinusmutabilis S.), quinoa (Chenopodium quinoa W.) and cañihua (Chenopodium pallidicaule A.). Other studies have shown the development of dehydrated soups based on broad beans (vicia faba, L.) flour (Macías and Vinces, 2011), rice (Oryza sativa) flour (Loor and Arcos, 2011), among others.

Previous works include the paper by López (2015), who applied three thermal treatments finding that the antioxidants, sensory characteristics and pH were maintained at 90° C for 2 minutes (min) and 90 °C for 15 seconds. In another work on chicken soup, the authors (You, Yang, Song, Zhang, and Liu, 2020) implemented sensory analysis to determine the best flavor from three different bone marrow sources.

In the same line, the food industry has developed several dehydrated products that have entered into the Colombian market. Some brands of soups are sold in chain stores and local markets. These soups contain pasta or noodles and have meat, hen, chicken, shrimp, or ribs flavor. Furthermore, the market offers traditional dehydrated soups in sachets, such as Ajiaco. This is a dish prepared with chicken (breast), creole potato (Solanum phureja), sabanera potato (Solanum tuberosum), corn (Zea mays) and spices, and is a traditional dish in the Colombian capital. The market also offers Sancocho, a soup prepared with beef, pork rib, cassava (Manihot esculenta), green plantain (Musa paradisiaca), ripe plantain, potato (Solanum tuberosum), arracacha (Arracacia zanthorrhiza), vegetables and spices (Ordóñez, 2012).

According to the market research conducted by Nielsen (2016), soups and broths are the third most consumed food for breakfast, noting that 26% of people eat them regularly. Similarly, soups and consommés are the products with the second largest growth in the family basket due to their price and ease of preparation, as concluded by the results of the Latam Retail Overview developed by the consultant Kantar Worldpanel.

This offer of products is limited in Colombia, as only soups widely known throughout the country are available. Similarly, the products described above contain some ingredients mentioned in traditional recipe books such as that by the Ministry of Culture, written by Ordóñez (2012). Therefore, the sensory characteristics, such as flavor and aroma, of industrialized soups are different to those of traditional Colombian products. Also, note that the soups available in the market show potential for product development because according to Gran libro de la cocina colombiana 82 traditional Colombian soups have been identified, of which 12 are traditional to Boyacá and Cundinamarca.

Considering the above and the small offer of industrialized regional traditional soups, we proposed this research to standardize and vacuum pack two traditional soups (cuchuco de trigo con espinazo de cerdo and sopa de indios), which are stored at freezing temperatures to provide convenience to gastronomic establishments, facilitate the logistics and the production to offer them to tourists and consumers in general, and increase the consumption of traditional food to achieve the recognition of the region's soups, reclaiming the culinary traditions. Standardizing the soup preparation and conservation processes will ensure the products' quality, which was evaluated through both soups' nutritional and sensory characteristics, allowing a comprehensive evaluation during the storage period. This, based on similar works such as those by Alozie and Ene-Obong (2018). They performed a sensory evaluation of sopa de hoja de agua (Talinum triangulare) and wild spinach soup (Gnetum africanum).

2. Materials and Methods

This research work was developed by selecting and adapting fresh vegetable and animal products according to each soup's usual recipes. The ingredients of each recipe were standardized. Once standardized, they underwent sensory evaluations to determine the product's acceptance when modifying cooking time and temperature variables. The sensory testers evaluated the soups before

https://doi.org/10.25100/cdea.v36i68.8702

and after storage at freezing temperatures to record any sensory changes. Finally, processes soups were analyzed through bromatology tests to determine their nutritional composition.

2.1. Stage 1. Standardization and packaging of two soups from Boyacá (cuchuco de trigo con espinazo de cerdo and sopa de indios)

2.1.1. Materials selection and classification. The commodities were acquired from local markets in Bogotá. First, the products were visually inspected, removing those that showed fungal or insect damage or color alterations that could affect the product's sensory characteristics and safety. The meats used were products with controlled maturation, according to the product's technical datasheet. In the case of dairy, the expiration date was verified to ensure the general quality of the food produced. Cereals were initially sieved to remove foreign bodies or traces of shells or stems. Later, the fresh products were washed and disinfected in a water-sodium hypochlorite solution. Finally, the raw materials were processed through cuts that are characteristic to each preparation.

2.1.2. Formulation of traditional soups of Boyacá. The formulations of the cuchuco de trigo and sopa de indios used for this research were selected from a review of the existing literature regarding Boyacá's cuisine, identifying the ingredients used in each soup and the usual preparation for each soup. The sensory score obtained for each soup recipe was decisive to select the final formulation. Depending on the results, the soups were reformulated according to their ingredients' flavor, viscosity, or flavor intensity.

2.1.3. Soup preparation. This section describes how to formulate, prepare, store, and evaluate the traditional sopa de indios and cuchuco de trigo con espinazo de cerdo.

- *Sopa de indios.* Previously washed and disinfected cabbage leaves were used. The leaves were then filled with approximately 12 g of a dough made with sautéed meat and onion, mixed with wheat flour and curds. Table 1 shows the final formulation. Once prepared, the indios (dough balls) were stored in the refrigerator until used. The soup base was prepared at a cooking temperature of 85 °C for 40 minutes, using potable water, pork rib, potato, carrot, onion, and condiments such as garlic, salt, and pepper. Then, the indios were added to the soup and cooked at 82 °C. Finally, the soup was vacuum packaged and stored at freezing temperatures.

Table 1. Sopa de Indios ingredients

Ingredients	%
Pork ribs	11.2
Water	45.8
Peeled and chopped potatoes	13.1
Grated carrot	10.4
Wheat flour	5.2
Curds	9.6
Beaten eggs (unit)	2.0
Butter	0.8
Chopped green onion	3.4
Salt	0.3
Pepper	0.2

Source: Authors' own elaboration.

Table 2. Ingredients for cuchuco de trigo con espinazo de cerdo

Ingredients	%
Pork backbone	8.9
Water	57.6
Chopped green onion	2.8
Chopped carrots	1.8
Crushed garlic	0.1
Creole potato with skin, cut in half	5.0
Chopped peeled potato	6.5
Wheat	4.7
Peas	2.6
Broad beans	3.7
Green beans	2.3
Cabbage cut into strips	2.7
Salt	0.6
Pepper	0.2
Wheat flour	0.6

Source: Authors' own elaboration.

- *Cuchuco de trigo con espinazo de cerdo.* This recipe comprises two stages that include the ingredients shown in Table 2. The

https://doi.org/10.25100/cdea.v36i68.8702

Table 3. Cooking time of both soups

	Cuchuco de trigo con espinazo de cerdo (minutes)			Sopa de indios (minutes)		
Time	a	b	c	d	e	f
Initial cooking	100	105	110	95	100	105
Additional cooking*	10	5	0	10	5	0

* Products were reheated and maintained at 82 °C for an additional time, evaluating the products' sensory characteristics.

Source: Authors' own elaboration.

condiments and the pork backbone were added to the potable water and cooked at 85 °C for 40 minutes. Then, the wheat was added and stirred for 20 minutes. Potato, peas, carrots, broad beans and beans were added later. The mixture was cooked at low fire (maintaining a temperature of 82 °C) for 20 minutes. Finally, the soup is vacuum packed and stored at a freezing temperature.

2.1.4. Sensory evaluation of Boyacá's traditional soups. The sensory evaluation was performed through the same hedonic test described in stage 1 to define the production variables that led to the product's best sensory profile. Following this evaluation, the final recipes for each soup were selected considering the best sensory profile.

2.1.5. Determining the cooking process. After initial cooking as described above, different cooking times and their effects on the product's sensory characteristics were evaluated. Three cooking times and temperatures for the sopa de indios and the wheat soup were proposed for this methodology. These are shown in Table 3.

2.1.6. Soup storage. The soups were cooled via thermal shock with ice. Then, they were packed in polyethylene vacuum bags of 22 cm x 18 cm and 70 micrometers. The product vacuum was made in an S20 Turbovay packing machine in the semi-solid packaging setting. The product was frozen for 60 days.

2.2. Stage 2. Sensory evaluation of stored products

A sensory evaluation was performed on the soups at 0, 30, and 60 days of storage. The samples were unfrozen in the refrigerator and then reheated to 82 °C. The group 6 semi-trained testers performed the sensory evaluation for the two soups selected considering the aroma: soup, cereal and pleasant, and taste: characteristic of the soup and cereal, the consistency and general appearance of the product, determined by letting the product flow over a surface. The attributes were evaluated on a scale of 1 to 3, with 3 being the highest score for each attribute and 1 the lowest. These scores are shown in Table 4. Data were analyzed through means and standard deviation, ultimately represented by radial diagrams.

Table 4. Frozen traditional soups evaluation parameters

Attribute	Characteristic	Score
Aroma	High	3
	Medium	2
	Low	1
Flavor	High	3
	Medium	2
	Low	1
Consistence or texture	Very viscous	3
	Viscous	2
	Non-viscous	1
Appearance	Very appetizing	3
	Appetizing	2
	Non-appetizing	1

Source: Authors' own elaboration.

2.3. Stage 3. Determining the nutritional composition

The bromatological tests to determine the nutritional contribution of the cuchuco de trigo and sopa de indios were carried out using physicochemical tests performed by

https://doi.org/10.25100/cdea.v36i68.8702

Table 5. Analytical methods used to determine physicochemical properties

Analysis	Method	Reference	Technique
Humidity	AOAC 950.46	AOAC (2008)	Gravimetric
Protein	NMX-F-608-NORMEX-2011	Mexican Standard. NMX-F-608-Normex-2011 (2011)	Volumetry
Ash	AOAC 920.153,	AOAC (1990)	Gravimetric analysis
Fat	NTC 668	Colombian Technical Standard. (1973)	Gravimetric analysis
Total Carbohydrates	Nutritional Labelling Codex	Codex Alimentarius. (1993)	Calculation
Calories (Atwater factor)	Nutritional Labelling Codex	Codex Alimentarius. (1993)	Calculation
Raw fiber	NTC 668	Colombian Technical Standard. (1973)	Gravimetric analysis

Source: Authors' own elaboration.

the Allchem laboratory in Bogotá, Colombia. The nutritional contribution was determined through the methods and techniques mentioned in Table 5, including the humidity, fat, ash, carbohydrates, and protein contents. Calories were calculated using the Atwater factor.

3. Results and Discussion

3.1. Stage 1. Standardization and packaging of two soups from Boyacá (cuchuco de trigo con espinazo de cerdo and sopa de indios) for their commercialization

Based on the ingredients and the methodologies described, the recipes to prepare the products were defined by establishing the final formulations described in Tables 1 and 2 for Sopa de Indios and Cuchuco de trigo con espinazo de cerdo.

The cooking time for cuchuco de trigo con espinazo de cerdo was 110 minutes, longer than the 90 minutes described by Ordóñez (2012). The cooking time for Sopa de Indios was 110 minutes, more than double the time mentioned by Ordóñez (2012) (45 minutes). This variation in time is due to beef bone in the broth and ground beef in the indios, as mentioned by tradition bearers in Boyacá. Ordóñez did not consider these ingredients that improved testers' acceptance.

3.1.1. Determining the cooking process. Considering the cooking times described above, an additional test that included a two-stage cooking process was performed to identify whether this change in the process would improve the sensory characteristics of the products, as several authors identify differences in the sensory characteristics of vegetables, hams, roots, meats and cold vegetable soups when varying the cooking times and temperatures (Borges, Von Atzingen, and Machado, 2004; González, Suárez, and Martínez, 2010; Gómez, 2012; Sánchez and Albarracín, 2010; López, 2015).

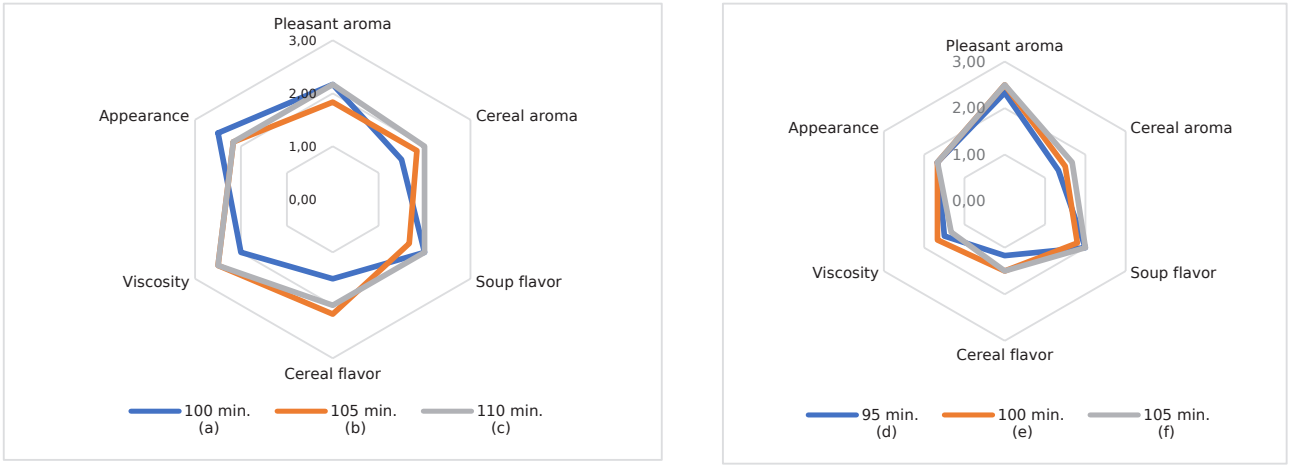
Then, a sensory comparison was performed with a sample with a single cooking stage. These soups were sensorially evaluated, finding that both soups were preferred by semi-trained panelists when they had an initial cooking time of 110 minutes for cuchuco sopa de indios. Figure 1 shows that the 100 and 105 minutes (min.) had the highest ratings regarding the soup and cereal flavor and a pleasant cereal aroma. These results are similar to the study by Bonamino *et al.* (2009), who found an intermediate acceptance of quinoa seed soup's flavor.

3.2. Stage 2. Sensory evaluation of the stored product

Following 60 days (d) of product storage, the testers rated the aroma, taste and viscosity characteristics with a higher score

https://doi.org/10.25100/cdea.v36i68.8702

Figure 1. Sensory evaluation of soups with different initial cooking times

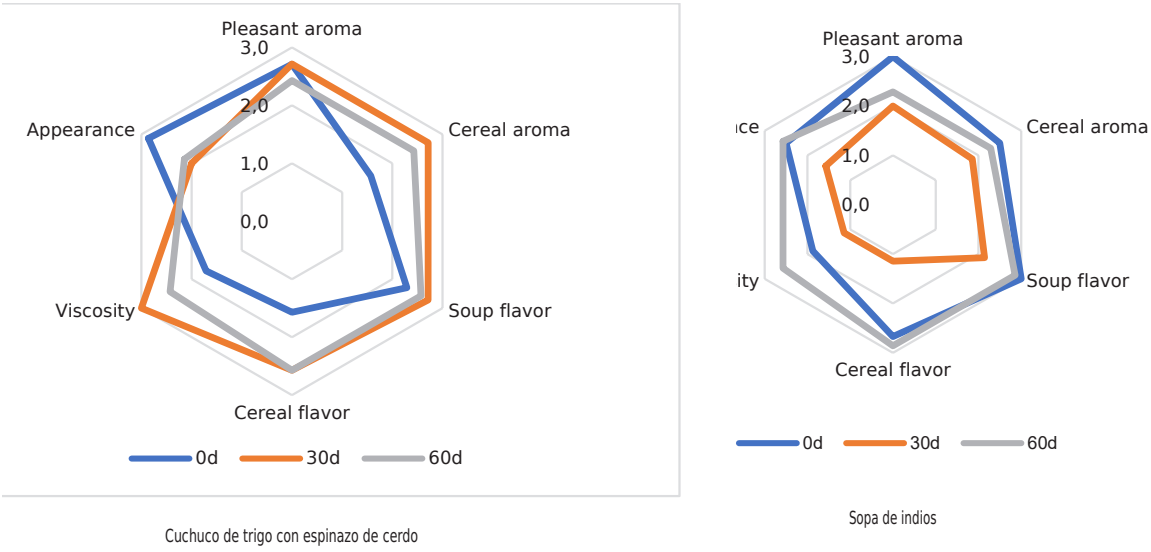


Cuchuco de trigo con espinazo de cerdo

Sopa de indios

Source: Authors' own elaboration.

Figure 2. Sensory Evaluation of soups under different storage times



Cuchuco de trigo con espinazo de cerdo

Sopa de indios

Source: Authors' own elaboration.

for cuchuco de trigo con espinazo de cerdo frozen and stored for 30 days, followed by the product stored for 60 days, whereas the fresh product only received the highest rating regarding the appearance; the other characteristics were rated below the stored soups. Figure 2 shows the results obtained.

On the other hand, sopa de indios received the best score for soup and cereal aroma on day 0. The product stored for 60 days received the highest score for appearance, viscosity, and flavor to cereal; therefore, storage for 60 days highlights some sensory characteristics. According to the (FDA, 2018), products such as soups and stews can be stored for 3 to 4 months in the refrigerator; however, the soups and stews the FDA mentions do not have animal protein, making their shelf life longer. In the case of this study, we observed

https://doi.org/10.25100/cdea.v36i68.8702

a maximum shelf life of 30 days for cuchuco de trigo con espinazo de cerdo and 60 days for sopa de indios, considering the periods during which the products maintained their sensory characteristics according to the testers' evaluations.

3.3. Stage 3. Determining Nutritional composition

Both soups have a moisture content of 77%, so these foods require storage in a refrigerator or freezer to maintain food safety. Regarding protein, cuchuco de trigo con espinazo de cerdo contains 7.35% protein, similar to sopa de indios contribution (6.51%). On the other part, the caloric contribution of cuchuco de trigo con espinazo de cerdo is 88 calories per 100 grams and 115 calories per 100 grams for sopa de indios, a contribution that is similar to sancocho and rice soup, i.e., 80 and 67 calories per 100 grams, respectively, according to the report by (ICBF, 2015). Table 6 contains the nutritional contributions.

Table 6. Nutritional composition of soups

Analysis performed %	Cuchuco de trigo con espinazo de cerdo	Sopa de indios
Moisture	77.66	77.43
Protein	7.35	6.51
Ash	1.39	1.31
Fat	1.51	6.11
Total Carbohydrates	11.13	8.54
Raw fiber	0.96	0.10
Calories (Atwater factor)	88 cal/100g	115 cal/100g

Source: Authors' own elaboration.

4. Conclusions

The preparation and subsequent vacuum storage of Sopa de indios and Cuchuco de trigo con espinazo de cerdo is an alternative for establishments wishing to offer traditional soups since they are converted into ready-to-eat foods to offer Boyaca's traditional dishes to diners.

Based on the process's standardization and the storage conditions, the sensory characteristics led to determine that prepared soups' shelf life is 30 days for cuchuco de trigo con espinazo de cerdo and 60 days for sopa de indios.

The country's traditional soups studied in this paper may be produced and stored at freezing temperatures, enabling an industrialization process for these products and their offer to the food industry.

5. Conflict of interest

The authors declare that they do not have any conflict of interest.

6. Funding sources

This research was sponsored by Fundación Universitaria Los Libertadores, program of Hotel and Tourism Administration. It was performed by researchers and members of the REAC (Economic, Administrative and Accounting Reflection) research group.

7. References

AINIA. (2017). Desarrollo de productos de IV y V Gama. Retrieved from https://www.ainia.es/html/i+d/fichas/cuartayquintagama.htm

Alozie, Y. E., & Ene-Obong, H. N. (2018). Recipe standardization, nutrient composition and sensory evaluation of waterleaf (Talinumtriangulare) and wild spinach (Gnetum africanum) soup "afang" commonly consumed in South-south Nigeria. *Food Chemistry, 238*(1), 65-72. https://doi.org/10.1016/j.foodchem.2016.12.071

Ángel, A. G. (2012). Recetario santafereño. Instituto Distrital de las Artes-Idartes. Recuperado de http://babel.banrepcultural.org/digital/collection/p17054coll3/id/21

Association of Official Analytical Chemists (AOAC). (1990). Official Methods of Analysis of the Association of Official Analytical Chemists. Section 920.153. Arlington, USA: AOAC.

Association of Official Analytical Chemists (AOAC). (2008). Official Methods of Analysis. Section 950.46. Washington D.C., USA: AOAC.

Bonamino, J., Carreño, I., y Cervilla, S. (2009). Elaboración de sopas a partir de la molienda de semillas de quinoa. *Invenio: Revista de investigación académica,* (23), 119-130. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=3394552

https://doi.org/10.25100/cdea.v36i68.8702

Borges, R. M., Von Atzingen, C., y Machado, M. E. (2004). Análisis sensorial y ácido ascórbico de hortalizas en fresco y ultracongeladas. *Ciencia y tecnología alimentaria, 4*(4) 240-245. Recuperado de https://www.tandfonline.com/doi/f/10.1080/11358120409487765?needAccess=true

Brennan, J., Butters, J., y Burgos, J. (1998). *Las operaciones de la ingeniería de los alimentos.* Zaragoza, España: Editorial Acribia

Codex Alimentarius. (1993). *Directrices sobre etiquetado nutricional CAC/GL 2-1985.* Recuperado de http://www.fao.org/about/en/

Colombian Technical Standard. (1973). *NTC 668. Alimentos y materias primas. Determinación de los contenidos de grasa y fibra cruda.* Bogotá, Colombia: Instituto Colombiano de Normas Técnicas y Certificación, ICONTEC, .

Córdova V., Francisco, B., y López, J. (2006). *Optimización del proceso de enlatado para sopa de caracol elaborada con receta garífuna.* Zamorano, Honduras: Escuela Agrícola Panamericana,

Di Clemente, E., Hernández, J. M., y López-Guzmán, T. (2014). La gastronomía como patrimonio cultural y motor del desarrollo turístico. Un análisis DAFO para Extremadura. *Tejuelo: Didáctica de la Lengua y la Literatura. Educación,* (9), 817-833. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=5385975

FDA. (2018). *Food and Drug Administration. Refrigerator and Freezer Storage Chart.* Retrieved from http://www.fda.gov/downloads/Food/ResourcesForYou/HealthEducators/UCM148133. pdf

Franco, D. (2011). *Sopas y caldos.* Recuperado de http://www.alimentosargentinos.gob.ar/HomeAlimentos/Publicaciones/revistas/nota.php?id=118

García, A., Pacheco-Delahaye, E., Tovar, J., y Pérez, E. (2007). Caracterización fisicoquímica y funcional de las harinas de arracacha (Arracacia xanthorriza) para sopas instantáneas. *CYTA-Journal of Food, 5*(5), 384-393. https://doi.org/10.1080/11358120709487717

Gómez, F. (2012). *Efecto de la temperatura y el tiempo de cocción en las características sensoriales y fisicoquímicas de un producto de V gama esterilizado derivado de chicuro (Stangea rhizanta).* (Tesis para optar al título de Ingeniero Agroindustrial). Universidad Nacional de Huancavelica. Recuperado de http://repositorio.unh.edu.pe/handle/UNH/2310

González, M., Suárez, H., y Martínez, O. (2010). Influencia del proceso de cocción y temperatura de almacenamiento sobre las características fisicoquímicas, microbiológicas y sensoriales del jamón de cerdo. *Revista Colombiana de Ciencias Pecuarias. 23,* 336-348. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=3635348

ICBF. (2015). *Tabla de composición de alimentos colombianos.* Recuperado de https://www.icbf.gov.co/bienestar/nutricion/tabla-alimentos

Kim, M. R., Kim, K. P., & Chung, S. J. (2019). Utilizing hedonic frame for projective mapping: A case study with Korean fermented soybean paste soup. *Food Quality and Preference, 71,* 279-285. https://doi.org/10.1016/j.foodqual.2018.07.014

Kumpulainen, T. E., Sandell, M. A., y Hopia, A. I. (2018). Effect of component quality on sensory characteristics of a fish soup. *Food science and nutrition, 6*(5), 1220-1228. https://doi.org/10.1002/fsn3.661

Llano, F., y Carrillo, E. (2015). *Viajeros, recetas e identidad gastronómica: de la mezcla cultural al reconocimiento local.* Primer Encuentro Nacional de Grupos de Investigación en Alimentos y Cocina Colombiana (pp. 8-10). Bogotá, Colombia: SENA. Recuperado de https://www.researchgate.net/publication/331592813_Viajeros_recetas_e_identidad_gastronomica_de_la_mezcla_cultural_al_reconocimiento_local

Loor, A., & Arcos, C. (2011). *Elaboración de sopa instantánea a partir de harina de arroz (Oriza sativa).* Guayaquil, Ecuador: Escuela Superior Politécnica del Litoral. Recuperado de http://www.dspace.espol.edu.ec/xmlui/handle/123456789/31351

López, R. (2015). Optimización de tratamientos térmicos de sopas frías vegetales para preservar su calidad, bioactividad y composición. Cartagena, Colombia: Universidad Politécnica de Cartagena. Recuperado de https://repositorio.upct.es/handle/10317/4957

Macías, J., y Vinces, R. (2011). *Elaboración de sopa instantánea a partir de harina de haba.* Recuperado de https://www.dspace.espol.edu.ec/bitstream/123456789/17031/1/Paper%20SOPA%20DE%20HABA.pdf

Maimone, M., Manukyan, A., Tranchida, P. Q., & Steinhaus, M. (2017). Odour-active compounds in the traditional Armenian soup seasoning herb Heracleum transcaucasicum. *European Food Research and Technology, 243*(6), 969-977. https://doi.org/10.1007/s00217-016-2815-9

https://doi.org/10.25100/cdea.v36i68.8702

Mexican Standard. (2011). *Alimentos-Determinación de proteínas en alimentos-Método de ensayo (prueba) NMX-F-608-Normex-2011.* Recuperado de https://www.colpos.mx/bancodenormas/nmexicanas/NMX-F-068-S-1980.PDF

MinCIT (s.f.). *Guía turística Boyacá, Colombia.* Recuperado de https://cdn.colombia.com/docs/turismo/sitios-turisticos/boyaca/boyaca.pdf

Nielsen. (2016). *Hábitos de desayuno de los hogares colombianos.* Recuperado de http://www.nielsen.com/co/es/insights/news/2016/Habitos-de-desayuno-de-los-hogares-colombianos.html

Ordóñez, C. (2012). *Gran Libro de la Cocina Colombiana.* Bogotá, Colombia: Ministerio de Cultura. Recuperado de https://www.mincultura.gov.co/Sitios/patrimonio/bibliotecas-de-cocinas/tomos/tomo09.pdf

Pololikashvili, Z. (2018, junio). Aprovechar el poder de la tecnología. *4ª edición del Foro Mundial de Turismo Gastronómico,* OMT. Bangkok, Tailandia. Recuperado de https://www.unwto.org/es/press-release/2018-06-04/foro-mundial-de-turismo-gastronomico-de-la-omt-aprovechar-el-poder-de-la-te

Ramírez, Á., Hinojosa, A. (2016). *Formulación, caracterización y evaluación sensorial de una sopa deshidratada a base de quinua (chenopodium quinoa wild) variedad Hualhuas. Huancayo,* Perú*:* Universidad Nacional del Centro del Perú.

Salazar, Y. (2012). *Microbiología de alimentos.* Bogotá, Colombia: UNAD.

Sánchez, I., y Albarracín, W. (2010). Análisis sensorial en carne. *Revista Colombiana de Ciencias Pecuarias,* (23) 227-239. Recuperado de https://www.redalyc.org/pdf/2950/295023450012.pdf

Unwto, W. (2016). *Gastronomy survey OMT.* Retrieved from https://www.ithotelero.com/blog/unwto-survey-on-gastronomy-tourism-elaborada-por-la-omt-y-madison/

Vega, Ó., y López, F. (2012). Rastreando alimentos típicos de Boyacá, Colombia. *Perspectivas en nutrición humana,* 211-221. Recuperado de http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-41082012000200009

Velezvía Díaz, J. D. (2005). *Elaboración de sopas reconstituibles en base de carachi (Orestiasagassii V.), tarhui (lupinusmutabilis S.), quinua (Chenopodiumquinoa W.) y cañihua (Chenopodium pallidicaule A).* Lima, Perú: Universidad Nacional Agraria La Molina. Recuperado de http://revistas.unife.edu.pe/index.php/sistemica/article/view/683

You, M., Yang, P., Song, H., Zhang, L., & Liu, P. (2020). Effects of three types of bone marrow extracts treated with different treatment methods on the taste of chicken soup. *Journal of Food Science and Technology, 57*(2), 638-649. doi: 10.1007/s13197-019-04095-9

Zhu, C., Zhao, G., Cui, W., Li, S., Yu, X., & Zhang, Q. (2020). Utilization of i-TRAQ technology to determine protein modifications in pork soup in response to addition of salt. *Journal of Food Composition and Analysis, 88*, 103453. https://doi.org/10.1016/j.jfca.2020.103453

How to cite this paper?

Cote Daza, S. P., Barón Chivara, J. A., & Moncayo Martínez, D. C. (2020). Developing Boyacá's traditional soups as frozen, vacuum-packed products. *Cuadernos de Administración, 36*(68), 3-13. https://doi.org/10.25100/cdea.v36i68.8702