



Title: Process standardization and its impact on the manufacture of amaranth products

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Introduction

Alejandre and Gómez (1986), comment that, in Mexico, agriculture is one of the priority and most important activities, generating a large number of jobs and responding to the basic needs of millions of people. According to the 2019 Agrifood Panorama, of the 54.9 million Mexicans who work, 5.5 million do so in agricultural activities. According to the profile of agricultural and fishing workers, 45.9% are subordinate and paid workers, 35.8% are own-account workers, 12.1% do not receive payments, and 6.2% are employers. According to data from INEGI (2014), the Mexican territory has an area of 198 million hectares, of which 14% (27.4 million) are considered to have agricultural vocation. Of the total agricultural area, the rainfed modality covers 79.7% (21.9 million), where basic crops stand out, such as corn, sorghum, beans, and wheat. However, the latter have presented various factors that hinder agricultural production, mainly due to the increase in prices of chemical inputs, of the labor that is used during the cultivation cycle, of the degradation of the land where it is produced and of climate change. Becoming some of the reasons why growers have decided to switch their crops to more adaptable alternatives, According to data from SIAP (2019), production is concentrated mainly in the central zone of Mexico, in the states of Puebla, Tlaxcala, Morelos, the State of Mexico and Mexico City. Highlighting the participation of the State of Puebla, contributing 61% (3,396 tons) of the national production (5,548 tons). Amaranth stands out as an important alternative for small producers that allows economic income in addition to that provided by the cultivation of corn, since it has agronomic characteristics that allow it to adapt to adverse environmental conditions, where other crops do not prosper (Islas and Islands, 2001) and capable of developing in soils of all kinds of qualities. Currently, groups of residents dedicated to the cultivation of amaranth have explored new forms of activities in search of economic growth for their families and to enhance the development of this seed through industrialization. Based on its adaptability to different environments and its nutritional properties. The small producers of these areas have adapted their homes in terms of equipment and infrastructure for the industrialization of amaranth, which has applications similar to that of basic crops, mainly corn, finding sweets and fried foods, such as joy sweets, atoles , flours with which breads, pastas, cakes and cookies are made, as well as its consumption as cereal. Despite the efforts, most of these microenterprises have notable deficiencies in terms of the design of their facilities, equipment and utensils, hygiene and sanitation practices both in the production process and in the establishment in general. Due to the aforementioned, the present investigation seeks to carry out a general analysis in the micro-enterprises of the municipalities of Tochimilco and Atzitzihuacán, Puebla; to propose strategies that serve as a guide towards compliance with current regulations established for food companies and the search for products that guarantee safety and quality specifications for consumer safety (Casas, A. et al; 2001).

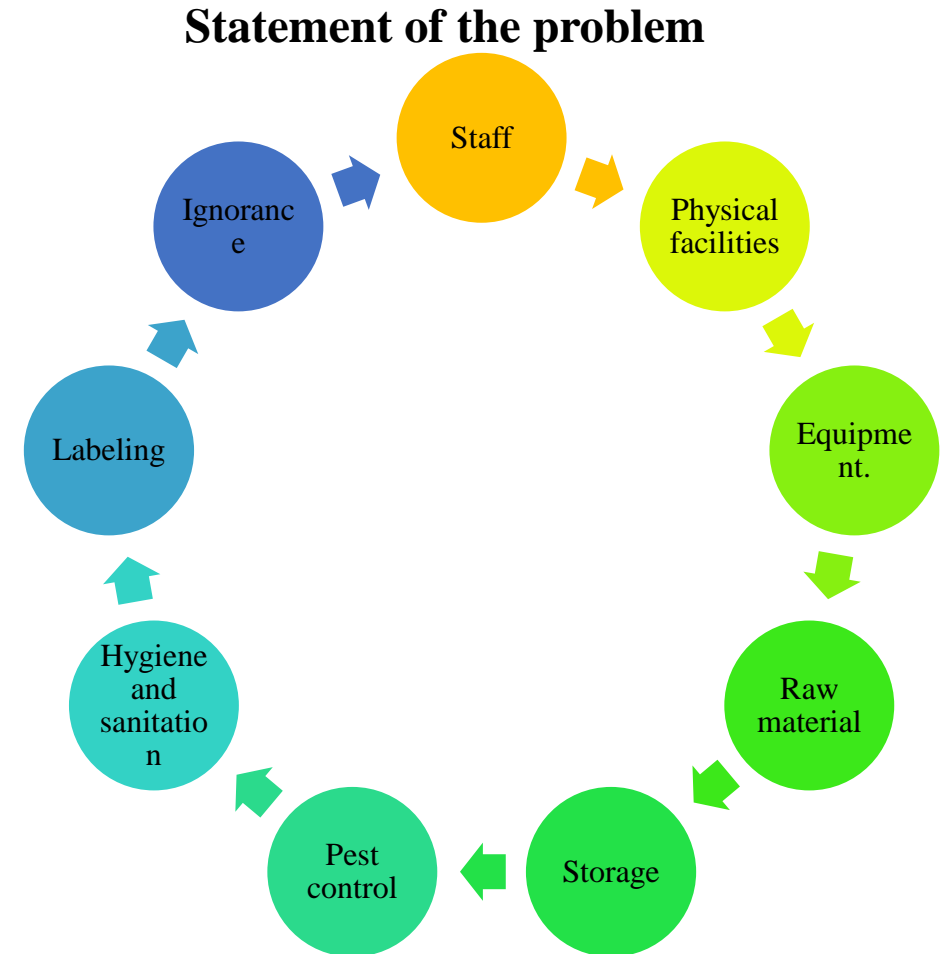
Objetives

General Objectives

Formulate an improvement strategy for the standardization in the production process of amaranth through the use of good practices and current regulations applicable to food industries, to generate a higher economic income in the producing families and create a higher level of competitiveness in the agro-industrial sector. microenterprises in the municipalities of Tochimilco and Atzitzihuacán.

Specific Objectives

- Define good practices for food processing to ensure their safety and innocuousness.
- Establish the current procedures and regulations applicable to establishments and processes for the production of food based on amaranth.
- Design a consultation document, which serves as theoretical support to improve the process of elaboration of amaranth products.



Source: Own elaboration

Rationale

Puebla is presented as the largest producer at the national level, however, the industrialization of amaranth is carried out mainly in the State of Mexico, Morelos and Tlaxcala. Although part of the grain used is obtained from their own plots, most of it is acquired through local producers or intermediaries who buy in the State of Puebla. Situation that affects economic growth in the municipalities of Atzitzihuacán and Tochimilco. In order to generate strategies that improve economic support, the inhabitants of these two municipalities, who are dedicated to the cultivation of amaranth, have developed micro-enterprises dedicated to the production of amaranth-based products. Being among its variety mainly sweets or fried foods, such as alegrías, atoles, cookies, breads, among others. Despite the fact that this activity generates a higher income than dedicating themselves only to cultivation, there are quality problems that prevent their proper growth, which are mainly generated by the lack of knowledge of the appropriate practices to be carried out during the transformation processes. the lack of technical assistance, equipment and technology and the training of the workforce. Through this project, the aim is to generate regulation strategies that serve as a guide to promote the use of good practices and regulations applicable to food industries in micro-enterprises in the municipalities of Tochimilco and Atzitzihuacán, to directly benefit around 50 residents of areas vulnerable members of family labor in these small industries. In addition to obtaining quality products that are integrated into the national market and make amaranth a viable option for the food industry, mainly due to its nutritional benefits.

Hypotheses

➤ **General Hypothesis:**

The definition of good practices and current regulations in the food sector will increase the competitiveness opportunities of micro-enterprises dedicated to the production of amaranth products and generate a higher income for families belonging to the municipalities of Tochimilco and Atzitzihuacán.

➤ **Specific Hypotheses**

1. The lack of knowledge about Good Practices in the micro-enterprises of the municipalities of Tochimilco and Atzitzihuacán dedicated to the elaboration of amaranth products, limits the guarantee of harmlessness and safety to consumers.
2. The application of current regulations and procedures to the food industry is conditioned by ignorance and lack of economic resources within micro-enterprises
3. The definition of methodologies and process improvement tools are essential tools for the standardization of the production process in micro-enterprises.

Methodology

✓ **Determination of the universe and obtaining the sample.**

According to the data presented in the reference framework, the population under study comprised 20 micro-enterprises from the municipalities of Tochimilco and Atzitzihuacán, dedicated to the production of amaranth-based products. Which are characterized by having various levels of progress, but most are in the process of formation and consolidation. For the purposes of this study, the sample was determined through convenience sampling, since due to the current SARS II-COVID 19 virus pandemic, visits to companies remained very limited.

✓ **Research techniques and data collection plan.**

Since it was sought to obtain a broader and deeper perspective of the phenomenon under investigation, a mixed research method was chosen. By generating a conjunction of qualitative and quantitative approaches, a data representation is obtained through texts; as well as the use of numerical variables, graphs, formulas and analytical models.

✓ **Questionnaire**

Based on the data collected in the previous point, a structured questionnaire was carried out aimed at microentrepreneurs in the municipalities of Tochimilco and Atzitzihuacán, where general data on families, productive activities, knowledge about aspects of food quality, production process were collected. and products offered. In addition, the dialogue with the owners allowed us to understand the perception they have about their companies, the limitations and the opportunities for improvement according to their experience.

✓ **Pareto Chart**

As part of the quantitative analysis, Table 1 shows the data obtained in the verification sheet of Good Manufacturing Practices and applicable regulations in micro-enterprises that produce amaranth products, in order to apply more complete systems related to safety management and quality in food production (Table 2. Comparative analysis of the percentages of compliance and non-compliance according to the verification sheet application applied to each of the companies).

Methodology

Table 1. Comparative analysis of the percentages of compliance and non-compliance according to the verification sheet application applied to each of the companies

Areato study													
Personal		Instalations		Equipation		Process		Storage		Control of plagas		Lclean and desinfection	
Compliant	Fails	Compliant	Fails	Compliant	Fails	Compliant	Fails	Compliant	Fails	compliant	Fails	compliant	Fails
4	5	6	13	6	5	2	8	2	2	0	4	1	1
3	6	5	14	4	7	2	8	2	2	0	4	1	1
5	4	6	13	3	8	2	8	1	3	0	4	1	1
5	4	10	9	7	4	3	7	2	2	0	4	1	1
4	5	6	13	5	6	2	8	1	3	0	4	1	1
6	3	9	10	7	4	2	8	1	3	2	2	1	1
27	27	42	72	32	3.4	13	47	9	15	2	22	6	6
50%	50%	37%	63%	48%	52%	22%	78%	38%	63%	8%	92%	50%	50%

Source: Own elaboration

Results

The results obtained during the analysis of the current situation are presented through the techniques and tools proposed in the methodology, carried out on the micro-enterprises of the municipalities of Atzitzihuacán and Tochmilco. The results collected in the verification sheet show the data that will serve as the basis for the elaboration of the Pareto Analysis; quantitatively showing the areas to be treated to reduce 80% of the problems found (Table 2. Values of the current situation in companies for the Pareto Analysis).

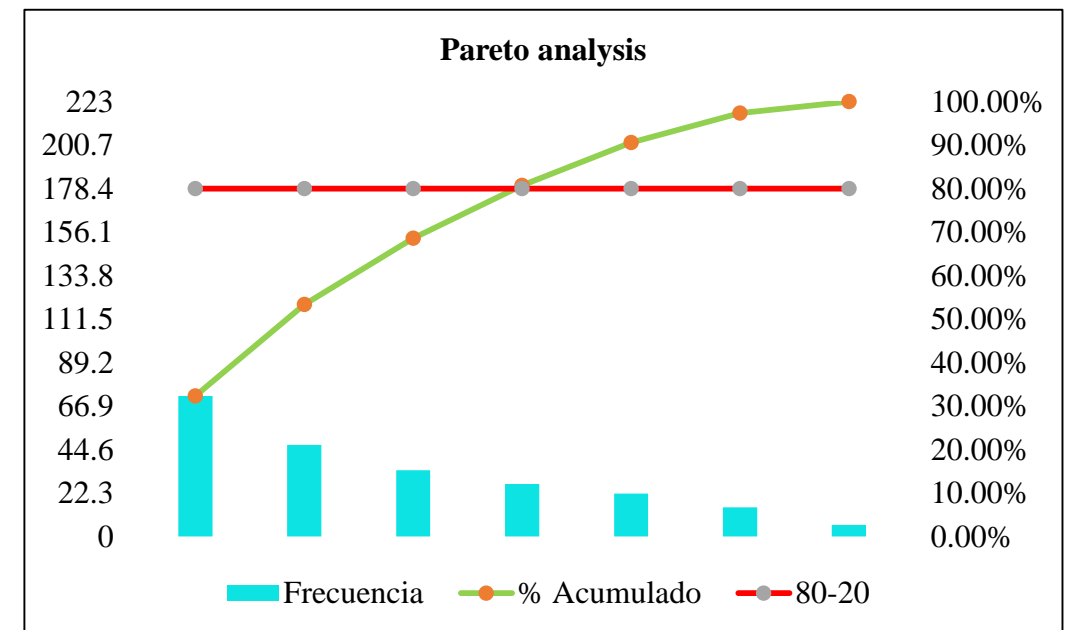
Pareto Analysis

For the Pareto analysis, the values of non-compliance by area of study in the micro-enterprises under study were taken as a basis (Figure 1. Pareto analysis of the micro-enterprises under study).

Table 2. Values of the current situation in companies for the Pareto Analysis

Areato study	Frequency	%	Accumulated %	Accumulated	80-20
Insfellings	72	32.29%	72	32.29%	80%
Process	47	21.08%	119	53.36%	80%
Equipment	3.4	15.25%	153	68.61%	80%
Personal	27	12.11%	180	80.72%	80%
Cpest control	22	9.87%	202	90.58%	80%
To thestorage	15	6.73%	217	97.31%	80%
Cleaning and disinfection	6	2.69%	223	100.00%	80%
Total	223	100.00%			

Figure 1. Pareto analysis of the micro-enterprises under study



Source: Own elaboration

As a result of the analysis of the data through the Pareto analysis (Table 3. Pareto analysis of the microenterprise), it was obtained that the Facilities, Process and Equipment areas are the cause of 80% of the problems found. Therefore, the improvement strategy was aimed at solving them and this will help reduce the quality problems found in the remaining areas

Table 3. Pareto analysis of the microenterprise

	Installations	Process	Equipment	Staff	Pest control	Storage	Cleaning and disinfection
Frequency	72	47	3.4	27	22	15	6
% Accumulated	32.29%	53.36%	68.61%	80.72%	90.58%	97.31%	100%
80-20	80%	80%	80%	80%	80%	80%	80%

Source: Own elaboration

Hypothesis testing

1. It was verified that all the microenterprises visited present failures, considering as the standard that should be fulfilled according to what is established in the Good Manufacturing Practices, which establish the minimum requirements to reduce the risks of intoxication and ensure safe food.

2. According to the investigation, it was confirmed that ignorance and mainly the economic factor condition the application of current procedures and regulations. Given that the companies studied are dedicated to food production, the regulations require care in the design of their facilities, the use of equipment and utensils that are easy to clean and disinfect, correct storage of materials, among others. Situations that require an economic investment that many times is not among the possibilities of microentrepreneurs.

3. It was found that the problems found belong to the objectives sought by the continuous improvement methodologies and tools. Although your application will not be evaluated, these tools are the first step in standardizing processes.

In summary, the analysis showed that the areas found in the Pareto diagram fit the root causes Environment and Method found in the Ishikawa Diagram. Therefore, the improvement strategy was aimed at solving them.

Conclusions

During the last years, the cultivation of amaranth has caused an increase of interest at a national and international level, mainly due to its nutritional elements. Although this seed was of great food importance during pre-Hispanic times, the arrival of the Spanish made it a forgotten crop.

INEGI, (2016) indicates that the State of Puebla stands out as the largest producer of amaranth, mainly the municipalities of Tochimilco and Atzitzihuacán. Places where small producers have found a viable option to increase the income of their families. Not only carrying out cultivation activities of this seed, but also industrializing it.

Although this project has managed to contribute to the generation of income, they still have a long way to go. Reaching national and international markets entails the fulfillment of a number of requirements, especially due to the demand for hygiene and safety in companies in this area. To achieve this, an economic contribution is mainly required, but there are other activities that can be carried out as part of the search for quality.

Based on the elements analyzed in the results, it is concluded that there are a large number of deficiencies in the companies under study. Mainly because the producers do not comply with the requirements, regulations and minimum legal aspects established to reduce the risks of intoxication and thus ensure safe food for the consumer. As mentioned, their conditions are limited primarily due to the lack of economic resources and the lack of knowledge of the elements to be met.

Initially, industrial development can be achieved through the awareness of those involved about the demands involved in the preparation and sale of food, and the potential risks of not complying with adequate quality. Likewise, establishing the greatest effort to attack the main causes found, will be able to improve the conditions of the micro-enterprises found at the beginning and give way to position themselves in a competitive market.

Recommendations

There is a relationship between the microenterprises under study. Regarding the method, the strategies are based on the training of its employees, application of 5'S and application of an ANDON system.

Initially, it is necessary to make the members of the micro-enterprises aware of the benefits of adhering to the regulations that guarantee the quality of their products. Through the presentation of success stories, their scope, the demands that the food industry asks of companies to guarantee human safety and health, and faults for non-compliance with what is established (Krajewski, Ritzman and Malhotra, 2008).

Regarding training, current regulations indicate that the amaranth used as raw material must be inspected sensorially and, if necessary, establish laboratory tests. In the first case, the staff can be trained to sensorily verify that the amaranth grains meet the minimum requirements established in NMX-FF-116-SCFI-2010 and NMX-FF-114-SCFI-2009.

Integrate as part of the training the 5'S philosophy applicable to Method and Environment, through examples of its implementation and the benefits obtained by following its sequence correctly. Said training can be carried out through the use of technology with pre-recorded material or with the help of experts in the field of Good Manufacturing Practices.

Regarding the production processes, it is recommended to prepare a process manual available to employees, which establishes the order and development of operations to obtain standardized products.

For the warehouse areas, the ANDON System must be applied when marking the specific spaces for raw materials and finished products and the use of signs based on the NOM-026-STPS-2008 standard, as well as the type of furniture that will be used for their storage. protection and its specific characteristics.

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