




## GOOD MANUFACTURING PRACTICES IN THE PREPARATION OF SNACK BASED ON SACHA INCHI

### BUENAS PRÁCTICAS DE MANUFACTURA EN LA ELABORACIÓN DEL SNACK A BASE DE SACHA INCHI

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#### ABSTRACT

The objective of the research was to implement a Good Manufacturing Practices Manual in the FOCAZNOM association to comply with the quality standards established in ARCSA-DE-067-2015-GGG. A diagnosis of the preliminary conditions of the Sacha Inchi-based snack production line was carried out through a verification instrument known as a check list based on the documentation, requirements for facilities, equipment and utensils, and hygienic requirements for personal manufacturing, raw materials and inputs, production operations, packaging, labeling and packaging, storage, distribution and transportation to identify compliance with good manufacturing practices. It was found that 64% of the evaluated requirements do not meet the requirements established in ARCSA-067-2015-GG for the

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implementation of a Good Manufacturing Practices manual because the previous microbiological analyzes showed high microbial load in mesophilic aerobes, molds and *E. coli*. With respect to the training phase for the actors involved in the production process, a percentage of 83% was achieved in compliance with the quality indicators and in the microbiological analyzes the microbial load was generally reduced. It is concluded that the measures used in this research in relation to the quality and safety of the snack were met with a product suitable for consumption.

**Keywords:** Quality, safety, fatty acids, GMP.

## RESUMEN

La investigación tuvo como objetivo implementar un Manual de Buenas Prácticas de Manufactura en la asociación FOCAZNOM para cumplir con los estándares de calidad establecidos en el ARCSA-DE-067-2015-GGG. Se realizó un diagnóstico de las condiciones preliminares de la línea de producción de snack a base de Sacha Inchi a través de un instrumento de verificación conocido como check list en función a la documentación, requisitos de instalaciones, equipos y utensilios, requisitos higiénicos de fabricación personal, materia prima e insumos, operaciones de producciones, envasado, etiqueta y empaquetado, almacenamiento, distribución y transporte para identificar el cumplimiento de las buenas prácticas de manufactura. Se obtuvo que el 64% de los requerimientos evaluados no cumplen con los requisitos establecidos en el ARCSA-067-2015-GG para la implementación de un manual de Buenas Prácticas de Manufactura porque los análisis microbiológicos previos evidenciaron alta carga microbiana en aerobios mesófilos, mohos y *E. coli*. Con respecto a la fase de capacitación a los actores

involucrados con el proceso productivo se alcanzó un porcentaje de 83% en el cumplimiento de los indicadores de calidad y en los análisis microbiológicos se logró reducir en forma general la carga microbiana. Se concluye que las medidas empleadas en esta investigación en relación a la calidad e inocuidad del snack se cumplió con un producto apto para el consumo.

**Palabras clave:** Calidad, inocuidad, ácidos grasos, BPM.

## INTRODUCTION

The need to produce products that guarantee food quality and safety implies compliance with Good Manufacturing Practices (GMP) to identify critical control points in the production process (Oto y Prado, 2023). In this context, the Federación de Organizaciones Campesinas de la Zona Norte de Manabí (FOCAZMOM) is located in the province of Manabí, in the canton of San Vicente, and is dedicated to processing Sacha Inchi-based snacks.

Sacha inchi is a seed similar to the peanut kernel that contains polyunsaturated, monounsaturated and saturated fatty acids that help eliminate triglycerides, cholesterol and accumulated fats in the body (Martínez, *et al.*, 2021; Aranda, Villacrés y Ríos, 2019). Traditionally, this seed has been consumed by some populations of the Andean region, in liquid and solid food preparations (Vásquez, 2016).

FOCAZMOM does not have the first level of quality that involves GMP-oriented techniques in the snack production line, for example, basic hygiene measures used in the process, lack of quality control parameters in the raw material before, during and after processing, personnel protection measures, records of control points and non-compliance with national regulatory requirements.

Regarding this problem, Martínez (2020) states that among the main problems in the production of snacks are hygiene and personal protection measures, since they are sources of contamination that affect the product.

For this purpose, the association requires the need to obtain certification from the National Agency for Regulation,

Surveillance and Sanitary Control (ARCSA) to implement a GMP system. It is worth considering, that the implementation of GMPs is indispensable in the production of a product and suitable for human consumption and that it considers hygiene measures and proper handling (Ruedas, 2019).

Taking into account, in a global context the Food and Agriculture Organization of the United Nations assures that food safety is fundamental for the promotion of health and

## MATERIALS Y METHODS

**Location:** The research was developed in the FOCAZNOM association, located in San Vicente canton, Manabí province. The peroxide index analyses were carried out in the laboratory of the Faculty of Zootechnical Sciences of the Technical University of Manabí, Chone extension, while the microbiological analyses took place in the environmental microbiology laboratory of the Escuela Superior Politécnica Agropecuaria de Manabí Manuel Félix López, located at the El Limón site in Bolívar cantón, Manabí province.

**Diagnosis:** The conditions of compliance with Good Manufacturing Practices (GMP) in the FOCAZNOM association were

the eradication of hunger, therefore there is no food security without safety (FAO, 2019).

In relation to the exposed problematic the present research is focused on implementing a Good Manufacturing Practices Manual in the FOCAZNOM association to comply with the quality standards established in the ARCSA-DE-067-2015-GGG.

evaluated through an interview based on a series of open-ended questions directed to the legal representative. A verification instrument (checklist) was used in accordance with the provisions of Resolution ARCSA-DE-067-2015-GGG, with the objective of determining the overall percentage of compliance both before and after the implementation of the manual.

**Implementation of the GMP manual:** The legal representative and personnel of the FOCAZNOM organization were trained in various aspects, such as documentation, requirements for facilities, equipment and utensils, hygienic requirements for manufacturing personnel, handling of raw

materials and inputs, production operations, packaging, labeling and packing, as well as procedures related to storage, distribution and transportation. These trainings were carried out in

accordance with the requirements established in the Good Manufacturing Practices Manual.

## RESULTS AND DISCUSSION

Table 1 shows the degree of compliance with the requirements established in the Good Manufacturing Practices (GMP). Of the 76 requirements analyzed, 49 of them do not comply with the established standards, representing 64%, while 27 requirements do comply, equivalent to 36%. Based on these results,

improvements are needed in several areas, including documentation, requirements for facilities, equipment and utensils, hygienic manufacturing requirements, handling of raw materials and inputs, production operations, packaging, labeling, packing, storage, distribution and transportation.

**Table 1.** GMP pre-implementation results.

Requirements	If compliant	Noncompliant	Total
Documentation	3	5	8
Installation requirements	10	13	3
Equipment and utensils	2	6	8
Personal manufacturing hygiene requirements	5	7	12
Raw materials and supplies	2	5	7
Production operations	3	4	7
Packaging, labeling and wrapping	0	4	4
Storage, distribution and transportation	2	5	7
<b>Total</b>	<b>27</b>	<b>49</b>	<b>76</b>
<b>Percentage (%)</b>	<b>36</b>	<b>64</b>	<b>100</b>

Table 2 presents the verification of the requirements according to each parameter detailed by Resolution ARCSA-DE-067-

2015-GGG, following the implementation of the Good Manufacturing Practices Manual. It highlights a notable improvement in compliance with requirements related to

documentation, facilities, equipment and utensils, hygienic requirements for personnel, raw materials and inputs, production operations, packaging, labeling

and packing, as well as in storage, distribution and transportation areas.

**Table 2.** GMP post-implementation results.

Requirements	If compliant	Noncompliant	Total
Documentation	6	2	8
Installation requirements	20	3	23
Equipment and utensils	7	1	8
Personal manufacturing hygiene requirements	10	2	12
Raw materials and supplies	5	2	7
Production operations	6	1	7
Packaging, labeling and wrapping	3	1	4
Storage, distribution and transportation	6	1	7
<b>Total</b>	<b>63</b>	<b>13</b>	<b>6</b>
<b>Percentage (%)</b>	<b>83</b>	<b>17</b>	<b>100</b>

Corresponding to the study conducted, a 47% improvement was achieved in compliance with the parameters established in the standards of ARCSA-DE-067-2015-GGG through the implementation of the Good Manufacturing Practices (GMP) manual. Carvajal (2017) highlighted significant improvements, reaching 89,36% in plant adequacies, 91,67% in relation to equipment, and 94,74% in personnel hygienic requirements.

Several studies have highlighted the significant benefits derived from the implementation of these practices, demonstrating continuous improvements exceeding 70% in artisanal microenterprises. This proactive approach to food quality and safety not only contributes to safeguarding product integrity, but is also linked to a substantial increase in operational efficiency and customer satisfaction. The adoption of Good Manufacturing Practices (GMP) not only proves to be an essential measure to comply with regulatory standards, such as

NTE INEN 2570:2011 and ARCSA-DE-067-2015-GGG, but is also configured as a key strategy to strengthen FOCAZNOM's competitive position in the market. This, in turn, opens up opportunities for sustainable growth and greater acceptance of its products in the commercial arena (Intriago

y Vera, 2019; Barberán, 2023 y Quiñonez y Villegas, 2023).

The results of the analysis of the peroxide value in the Sacha Inchi snack are presented below (see Table 3).

**Table 3.** Results of the peroxide index pre-implementation of snack GMP.

Sample	Value	Unit	Reference NTE 2570:2011	Test Method
Sacha inchi snack	6,7216	mEq O <sub>2</sub> /Kg (in the extracted fat)	Max. 10	NTE INEN-ISO 2570

Table 4 shows the results of the microbiological analyses prior to the application of Good Manufacturing Practices (GMP). The absence of *E. coli* is

observed, while the presence of molds and standard plate counts is detected in the snack.

**Table 4.** Microbiological results prior to GMP implementation.

Sample per treatment	Test requested	Unit	Acceptable	Not acceptable	Results	Test method
Sacha inchi snack	Standard mesophilic aerobic plate count	UFC/g*	10 <sup>3</sup>	10 <sup>4</sup>	1,6x10 <sup>5</sup> Not acceptable	NTE INEN 1529-5
	Molds	UFC/g*	10	10 <sup>2</sup>	6,3x10 <sup>3</sup> Not acceptable	NTE INEN 1529-10
	<i>E. coli</i>	UFC/g*	<10	-	<1 Acceptable	NTE INEN 1529-7

Table 5 shows the results of the peroxide value analysis of the Sacha Inchi snack.

**Table 5.** Results of the peroxide index after implementation of the snack GMP.

Sample	Value	Unit	Reference NTE 2570	Test Method
Sacha inchi snack	3,689	Meq O <sub>2</sub> /kg (in the extracted fat)	Max. 10	NTE INEN-ISO 2570

These results are in line with the Codex Alimentarius recommendation, which establishes a range of 5 to 10 mEq/Kg for fats and oils used in the manufacture of grain-based foods (Huanatico et al., 2021).

Table 6 shows the results of the microbiological analyses performed on the Sacha Inchi snack.

**Table 6.** Microbiological results after GMP implementation.

Requested Test	Ranges		Test Method	Number of samples applied	
	m (acceptance)	M (rejection)		Before	After
Standard mesophilic aerobic plate count	10 <sup>3</sup> UFC/g*	10 <sup>4</sup> UFC/g*	NTE INEN 1529-5	1,6x10 <sup>5</sup> Rejection	0 Acceptable
Molds	10 UFC/g*	10 <sup>2</sup> UFC/g*	NTE INEN 1529-10	6,3x10 <sup>3</sup> Rejection	0 Acceptable
<i>E. coli</i>	<10 UFC/g*	-----	NTE INEN 1529-7	<1 Acceptable	0 Acceptable

The results of the microbiological analyses, both before and after the implementation of the standard plate count for mesophilic aerobes, molds and *E. coli*, revealed zero microbial load values in the snack samples. These results comply with the maximum permitted limit according to NTE INEN 2570:2011, thus ensuring a product suitable for human consumption.

Salazar y Barén (2018) indicate that a successful implementation of Good Manufacturing Practices (GMP) ensures the production of healthy, non-toxic and high-quality food. Also, with this implementation, FOCAZMOM could boost its sales, thus generating an increase in productivity.



## CONCLUSIONS

The initial diagnosis at FOCAZMOM revealed a 36% non-compliance with Good Manufacturing Practices (GMP) requirements, as well as high mesophilic aerobic and mold counts that exceeded the maximum limits allowed by NTE INEN 2570:2011.

The implementation of the Good Manufacturing Practices Manual managed

to reduce the microbial load in Sacha Inchi snacks, adjusting to the requirements established by NTE INEN 2570:2011 and ARCSA-DE-067-2015-GGG.

As a result of the measures applied in this research in relation to the quality and safety of the snack, it was possible to obtain a product suitable for consumption.

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