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## **Frutipan a Healthy Snack Alternative**

***El Frutipan una Alternativa de Snack Saludable***

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## **ABSTRACT**

The demand in the consumption of snacks opens field to the use of not common products in the market that have not been exploited and that can contribute a nutritional value for the human being; the snacks in general are products of massive consumption directed to people of different ages; the fruit is used that contributes a variety of nutrients rich in carbohydrates, proteins, fiber, vitamins and minerals, like raw material for the elaboration and commercialization of a quality product, new and with added value when being planned like a healthy snack. A pilot production is carried out considering what is specified in the INEN norms for vegetable products snacks, which were put to tasting with the acceptance of the product of 75.2 % which indicates that it is an alternative of consumption. For the commercial part, a survey was used with 11 questions that was applied to the population of the parishes of El Condado, Ponceano, Cotocollao and Carcelén in the city of Quito of 259,713, with a sample of 383 surveys, establishing an acceptance of the product at a price of \$1.13, as well as advertising conditions and characteristics of presentation and square; characteristics that depend on the case of the market study.

**Keywords:** Heart Rate, Frutipan, Blood Pressure, Regulation, Healthy Snack.

## **RESUMEN**

La demanda en el consumo de snacks abre campo al uso de productos no comunes en el mercado que no han sido explotados y que pueden aportar un valor nutricional para el ser humano; los snacks en general son productos de consumo masivo dirigidos a personas de diferentes edades; se utiliza el frutipan que aporta una variedad de nutrientes rico en carbohidratos, proteínas, fibra, vitaminas y minerales, como materia prima para la elaboración y comercialización de un producto de calidad, nuevo y con valor agregado al planificarse como un snack saludable. Se realiza una producción piloto considerando lo especificado en las normas INEN para bocaditos de productos vegetales, los cuales fueron puestos a degustación con la aceptación del producto del 75.2 % lo que indica que es una alternativa de consumo. Para la parte comercial se utilizó una encuesta con 11 preguntas que se aplicó a la población de las parroquias El Condado, Ponceano, Cotocollao y Carcelén de la ciudad de Quito de 259.713, con una muestra de 383 encuestas, estableciéndose una aceptación del producto a un precio de \$1.13, así como condiciones de publicidad y características de presentación y plaza; características que dependen del caso del estudio de mercado.

**Palabras clave:** Frecuencia Cardíaca, Frutipan, Presión Arterial, Regulación, Snack Saludable.

## INTRODUCTION

Poor eating habits induce a series of consequences that harm the health of people influencing the quality of life, from childhood (Otí García, 2018) to working life (Mendoza Garcia, 2017). Diseases related to lifestyle and poor diet share chronic diseases, especially heart disease, cardiovascular accidents, diabetes, obesity, metabolic syndrome, chronic obstructive pulmonary disease and some types of cancer. In Ecuador, diabetes is followed by hypertensive diseases. Both diseases are caused by poor eating habits and sedentary lifestyles. (Presidency of the Republic of Ecuador, 2020). This indicates that it is important to lead a healthy lifestyle, acquiring good routine practices of healthy eating. Diabetes (Calahorrano & Fernandez, 2018) is the second leading cause of death in Ecuador. The risk of developing this chronic noncommunicable disease is closely related to overweight and obesity that affect 6 out of 10 Ecuadorians. Regarding food, it should be noted that the snack market (Orduz et al., 2017) is aimed at people of different ages and social class, for this reason it has become as a strategy for inclusion as a healthy food due to its easy portability of consumption for all times and situations. Ecuador has strengthened and disseminated its specialized production of healthy snacks, directing its shipments to the main international markets, such as: USA (Mauricio-Delgadillo, 2019), Canada, Spain and Holland (PROCHILE, 2017). Ecuadorian consumers demand healthier products for reasons such as looking good and taking care of their health, fashion trend, advertising offered in vending sites such as neighborhood stores, supermarkets and others.

The breadfruit tree or frutipan (*Artocarpus altilis* and similar)(Dehnhard, 2020) is a species belonging to the genus *Artocarpus*, within the tribe *Artocarpeae*, of the family *Moraceae* with hundreds of varieties of trees distributed from Southeast Asia (Philippines, Indonesia), to Polynesia, through Oceania. The name frutipan (Martínez Centeno & Molina Molina, 2019) is derived from the texture of the moderately ripe fruit when cooked, similar to freshly baked bread and with a potato-like flavor. The frutipan tree occurs in tropical areas and its height is between 12 to 15 m, and can reach up to 26 m; the fruits can give you approximately 200 units per tree and these serve as food in many cultures.

On the other hand, snacks (Hess & Slavin, 2018) are a type of food that are generally used to temporarily satisfy hunger, provide a minimal amount of energy for the body, or simply for pleasure. The term comes from English, translating as appetizer or snacks. Consumption is generally at parties, home or movies.

Nutrition (Nápoles Pérez & Rodríguez García, 2019) is the intake of food in relation to the dietary needs of the organism. Good nutrition (a sufficient and balanced diet combined with regular physical exercise) is a fundamental element of good health. The definition of health given by the World Health Organization in 1948 is as follows: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity".

Therefore, it contemplates the healthy state of the person from the point of view of the quality of life and not simply from the manifestation of symptoms or the suffering of diseases. Therefore, frutipan pulp (Martínez Centeno & Molina Molina, 2019) contains copper, iron, magnesium, phosphorus and potassium; the latter regulates heart rate and blood pressure. The fiber in the pulp helps reduce cholesterol and protects the colon mucosa, preventing the proliferation of carcinogenic substances. The physical, chemical and nutritional characteristics of frutipan in raw, cooked/roasted, boiled, fermented and paste conditions. In addition, breadfruit (*Artocarpus altilis*) (Needham et al., 2020) is a long-lived tree whose fruits can be used as a cereal substitute as a nutritious and carbohydrate-rich staple food and thus contribute to food security.

The frutipan in some parts of the country is considered a food product of subsistence or basic consumption as it is: rice, cassava, green banana and potato, the production of this fruit does not require meticulous care since it is a tree of several meters high that as long as it has water blooms without difficulty, has nutritional values such as calcium, vitamins A and C, iron, phosphorus, protein, fiber and carbohydrates.

In view of the consumption of snacks in all ages and the nutritional properties of frutipan, this work proposes the elaboration and commercialization of snacks based on frutipan as a healthy snack venture that provides consumers with health benefits and corrects bad eating habits whose idea arises at the Universidad Tecnológica Indoamérica (Modelo Educativo Universidad Tecnológica Indoamérica, 2019) applying the socio-formative model (Tobón, 2017) at pilot level to establish market acceptance through the application of a survey.

The document is organized as follows: in the materials and methods section, the identification of the idea is established by establishing the conditions of the raw material Frutipan controlled with the specifications established by the INEN standard for vegetable products to then be subjected to transformation through the respective elaboration and validation of the characteristics according to the INEN standard for snacks. The feasibility with the evaluation of the impact on the market highlighting the properties of Frutipan used for the elaboration of snacks. In the product design, the process of elaboration of the Frutipan snack is explained, to finally make the commercial proposal through the market study, sample calculation, design and application of surveys. The Results section indicates the acceptance of the product and conditions for commercialization. Finally, conclusions and future work are presented.

## **MATERIALS AND METHODS**

The following are the stages developed in this study:

**Identification of the idea.** Frutipan has a high level of nutrients mentioned above, an accessible price, and a low supply in the market, so it meets the characteristics required to conduct a study for its commercialization in the form of a snack. Frutipan seeds can be

purchased from the Asociación de Agricultores Eloy Alfaro de Santo Domingo de los Tsáchilas (Plusideas, 2020). At this stage, the raw material is inspected in order to detect physical defects in appearance, surface, color and internal defects in accordance with NTE INEN 1516:2013 ((INEN), 2013). Once this is done, the raw material is purchased, transported and stored in the warehouse of the facilities according to the procedure established for this purpose, for a pilot production of 10 kg.

**Feasibility.** A technical process is carried out with details and real data on the project, including the market study, the production process, the technology to be used, the definitive production costs and the profitability of the project (Baca, 2001).

The survey (Fàbregas & del Amo, 2016) is a technique that serves to obtain information systematically about a given population, based on the answers provided by a small part of the individuals who are part of that population. As opposed to the census, which would collect information, it is a technique that serves to obtain information systematically about a given population, based on the answers provided by a small part of the individuals who are part of that population. Through the use of financial indicators such as NPV, IRR and TMAR, it is observed that the project is viable and profitable. In the market study, a 12-question survey is prepared to determine the acceptance of the product, which will be carried out in the study sector.

Dealing with the economic issue reflects the general amount of the investment, income and costs without going deeper into the project (Baca, 2001). Applying the methodology, the analysis of the macro and micro environment is carried out.

**Product Design. The next step** is the product design phase (Kotler, P., & Armstrong, 1991). Frutipan potatoes are processed with the following activities: washing, cooking, cutting, frying, checking and packaging; in each of the steps the handling is done in order to maintain quality during transport, storage and distribution until the final sale. And to ensure product quality, the NTE INEN 2561:2010 ((INEN), 2014) standard is used, by controlling the moisture requirement of maximum 5%, established for snacks of vegetable products.

Table 1

Product Design Phases

Phase	Activity
Evaluation of the problem	Identifying people who eat healthy snacks
Design Specifications	Determine the selling price, physical quantity of the product, ingredients, packaging.
Idea Generation	Idea identification strategy
Conceptual Design	Research the properties of Frutipan
Detailed Design	Composition, snack processing

**Testing and Presentation of the prototype of the viable product**  
**Manufacturing**

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For the evaluation of the commercial proposal, the methodology applied is presented below: **Market Study**. As study population (Fernandez, 2017) (Barros-Bastidas, Turpo, 2020), Gamboa Romero, M. A., Barros Morales, R. L., & Barros Bastidas, C. (2016) considered people over 12 years old in the North sector of the City of Quito shown in the following table:

Table 2  
*Demographic Dimension (INEC, 2010)*

VARIABLE	DESCRIPTION	N° INHABITANTS
<b>Country</b>	Ecuador	17'363.499
<b>Region</b>	Sierra	7'622.019
<b>City</b>	Quito	2'573.922
<b>Parishes:</b>	El Condado, Ponceano, Cotocollao, Carcelén.	259.713

For the calculation of the sample the population of the city of Quito parishes El Condado, Ponceano, Cotocollao and Carcelén is taken as reference, which is a finite population with a total of 259713 inhabitants according to the National Institute of Statistics and Census (INEC, 2010) therefore to obtain the sample the following formula is applied (1) according to (Fischer De La Vega, L. & Navarro Vega, 1996).

$$n = \frac{Z^2 P Q N}{e^2 (N - 1) + Z^2 P Q} \quad (1)$$

Where:

n = sample size

Z = confidence level, for 95% certainty Z = 1.96

P = probability of occurrence, 50% P = probability of occurrence, 50% P = probability of occurrence, 50%

Q = probability of non-occurrence, 50% Q = probability of non-occurrence, 50% Q = probability of non-occurrence, 50%

N = population or universe

e = sampling error, 5%.

$$n = \frac{(1.96)^2 * (0.50) * (0.50) * (259713)}{(0,05)^2(259713 - 1) + (1.96)^2 * (0.50) * (0.50)} = 383$$

Upon analyzing the results obtained from the sample, it was determined that the number of surveys to be conducted is 383.

**Survey Design.** The survey (Font Fàbregas, 2016) and Barros-Bastidas, C., & Turpo, O. (2020) is a technique that serves to obtain information in a systematic way about a given population, from the answers provided by a small part of the individuals who are part of that population. As opposed to the census, which would collect information, it is a technique used to obtain information systematically about a given population, based on the answers provided by a small part of the individuals who are part of that population. As a study instrument, a 12-question questionnaire is elaborated to be applied to the people in the sector, in order to carry out the study and measure the degree of acceptance of the products.

## RESULTS

Based on the methodological perspective section considered, the present project started from the idea identification strategy, through which the production of snacks based on frutipan has been proposed thanks to the benefits and nutritional properties of the fruit, for which the main components contained in the fruit such as fiber, iron, calcium, phosphorus, vitamins A and C will be taken. As for the feasibility stage, a market study and financial analysis will be carried out.

The price of the snacks will be determined by averaging the prices of the competition and the prices that customers are willing to pay for the product established in the market study. The sleeve has a label with the product specifications such as: ingredients, net content and brand logo.

The presentation of the snack will be 80g, in a kraft doypack package with the brand logo, nutritional information and the ingredients used in its preparation.

Next, for the market study, a questionnaire was prepared as an instrument that was applied to 383 people in the sample.

It is established that 75% of potential buyers are willing to buy the snack based on frutipan, while 25% would not be willing to buy it because they are unaware of its properties.

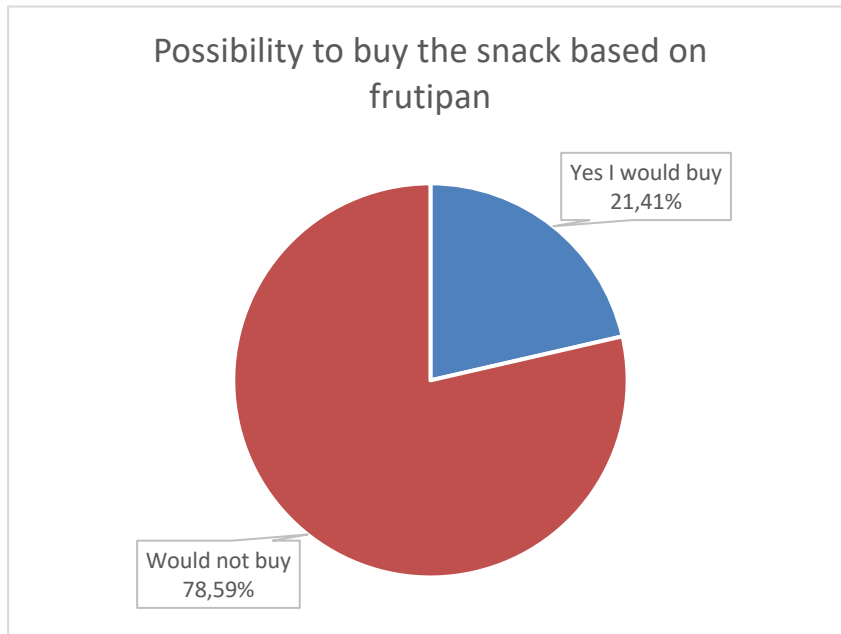


Figure 1 Possibility to buy the snack based on frutipan

From the surveys conducted, it was determined that people maintain a snack consumption habit of 70% in the city as can be seen in Figure No. 2.

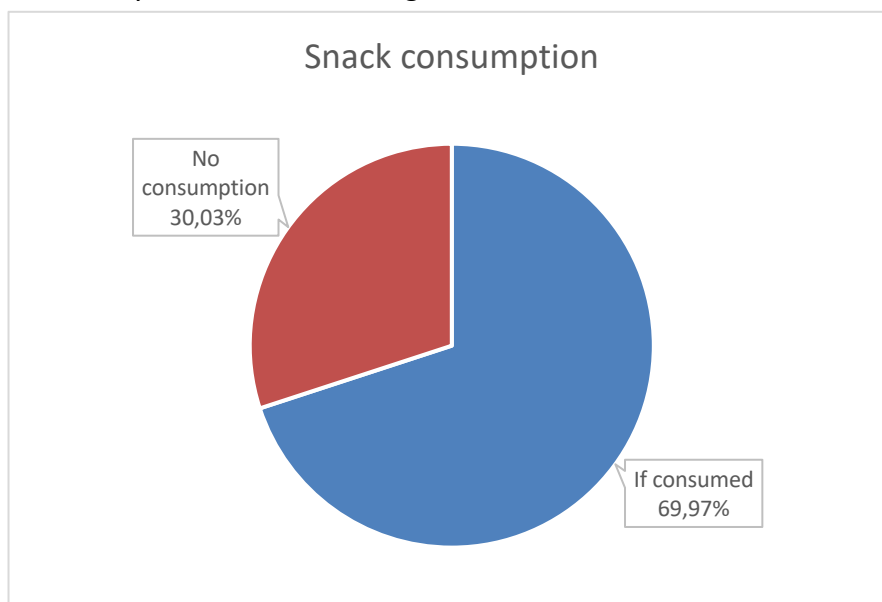


Figure 2 Snack consumption

In another question, the market for snacks is welcomed by people who usually buy potatoes in bags with 25%, chifles with 21% and fried beans with 19%. This represents an opportunity for the production of frutipan, a fruit with similar characteristics to the aforementioned products. The results are shown in Table 3.

Table 3

*Regular snack consumption*

Options	Frequency	Percentage
Potatoes in casing		
Fried beans		
Chifles		21%
Dried fruit		
Assorted snacks		17%
<b>TOTAL</b>	<b>383</b>	<b>100%</b>

The response to the frequency of purchase and quantity of snack consumption shows that people have a consumption habit of 44% weekly, 3% monthly; and with respect to the quantity, between 1 to 2 units with 40%, with a lower percentage, but no less important are the people who buy more than 5 units with 22%, which are possibly the people who buy for social events or family gatherings; therefore, the opportunity of the product according to the frequency of purchase is greater. The results are shown in Table 4 below:

Table 4

*Amount of snack consumption*

Options	Frequency	Percentage
1 to 2 units		
3 to 4 units		37%
More than 5 units	86	22%
<b>TOTAL</b>	<b>383</b>	<b>100%</b>

Regarding the justification considering that people lead a busy life rhythm by which the consumption of snacks in most of the cases is evidenced that the people surveyed with the highest percentage of relevance we have 45% that buy for being a fast food, with 6% acquire for its nutritional component, which they consider that the fruit when transformed to snacks loses its nutrients; this indicates that there is an opportunity for the creation of the product since it meets the characteristics that the consumer requires. The results are shown in Figure 3 below:

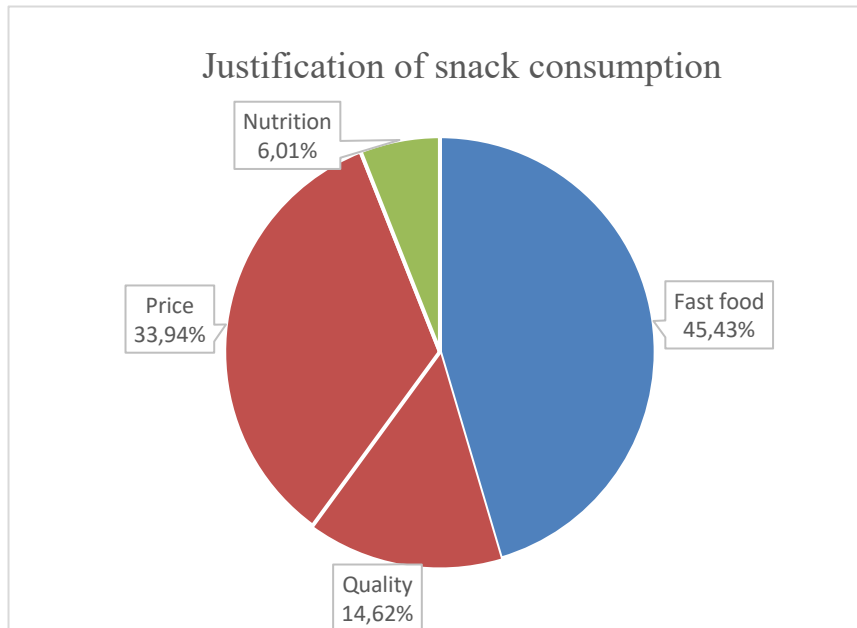


Figure 4 Justification of snack consumption

Table 5 presents the knowledge of the characteristics and nutritional benefits of frutipan or breadfruit, people do not know the plant or its properties with 79%, this may be due to the fact that the fruit is from a warm climate, while 21% say they know the fruit.

Table 5

*Knowledge of the characteristics of frutipan*

Options	Frequency	Percentage
Yes	82	21%
No	301	79%
<b>TOTAL</b>	<b>383</b>	<b>100%</b>

Regarding the quality considerations that respondents have regarding the snacks, it is established that people give greater importance to the nutritional content with 46%, while with a lower percentage they consider the brand with 14% to qualify a product as good. Therefore, the frutipan snacks product has good expectations in the market, since it contains a high nutritional value, Table 6.

Table 6

*Product quality considerations*

Options	Frequency	Percentage
The price		24%
The brand		14%
Physical appearance	58	
Nutritional content		46%
<b>TOTAL</b>	<b>383</b>	<b>100%</b>

Another question establishes the preference of the place of purchase of the snacks, with 49% preferring to buy the products in supermarkets, due to the variety available in them, while a smaller percentage of people prefer to buy from street vendors (3%). Under this consideration, agreements can be made to be able to offer snacks and be available to the client, Figure 4.

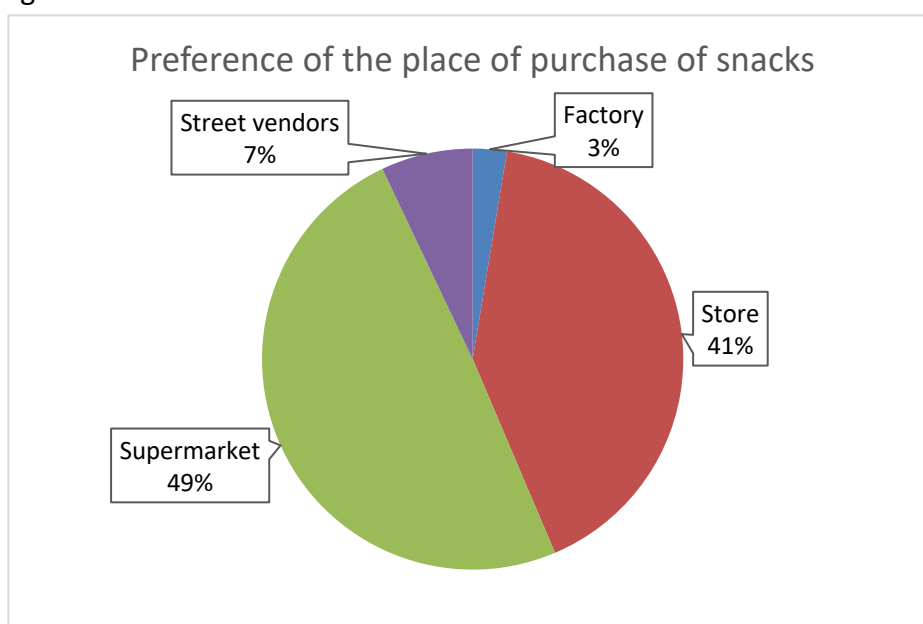


Figure 4 Preference of place of acquisition of snacks

When asked about the preferred presentation for the purchase of snacks, 53% of the respondents preferred individual 80g bags, due to their affordability, while 13% preferred 6-packs of 80g bags, Table 7.

Table 5

*Preferred presentation for the purchase of snacks*

OPTIONS	FREQUENCY	PERCENTAGE
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<b>Single bag 80g</b>	202	53%
<b>250g family bag</b>		34%
<b>Pack of 6 bags 80g</b>		13%
<b>TOTAL</b>	<b>383</b>	<b>100%</b>

Finally, the price they would be willing to pay for an 80 g bag of frutipan snacks was established, with values ranging from \$1.00 to \$1.25 for 83%, while 2% considered that it should be \$1.51 to \$1.75 (Figure 5).

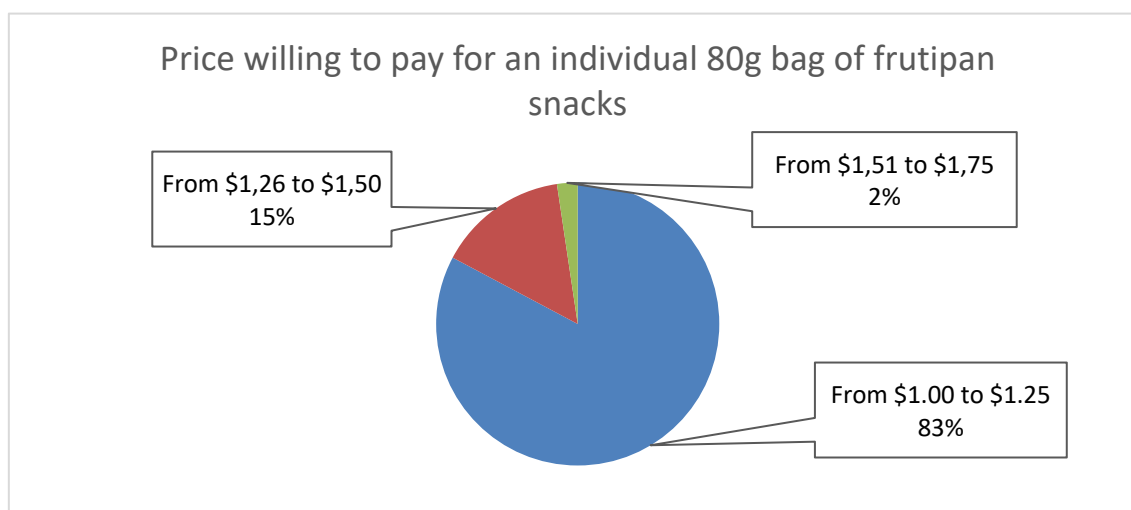


Figure 5 Price willing to pay for an individual 80g bag of frutipan snacks

The demand in the consumption of snacks opens the field to the use of uncommon products in the market that have not been exploited and that can provide nutritional value for the human being and considering that snacks in general are mass consumption products aimed at children, youth and adults of different ages, the frutipan of scientific name *Artocarpus altilis* is used, which provides a variety of nutrients rich in carbohydrates, proteins, fiber, vitamins and minerals, for the development and marketing of a quality product, new and with added value using this raw material. Due to the nutritional conditions of frutipan, it can be used in the form of flour mixed with traditional products from Ecuador such as quinoa, which also has these properties, obtaining a flour of high nutritional content for human consumption in liquid or solid preparations such as cookies or bread.

Based on the nutritional properties of frutipan, people can be inclined to the consumption of frutipan snacks with an awareness campaign that allows those who do not know to stop consuming products that affect their health.

For the experimentation, a pilot production was carried out taking into account what is specified in the INEN standards for snacks of vegetable products, which were put to tasting

with a product acceptance of 75.2%, which indicates that it is an alternative for consumption and easy to acquire. For the commercial part, a survey was used as an instrument through a questionnaire of 11 questions that was applied to the population of the parishes of El Condado, Ponceano, Cotocollao and Carcelén of the city of Quito, Ecuador, corresponding to 259,713, with a sample of 383 surveys. To establish the selling price, the presentation of the product, packaging, place; characteristics that will depend on each case of the market study. As a result, the acceptance of the product at a price of \$1.13 was obtained, as well as advertising conditions and presentation characteristics.

## CONCLUSIONS

The work projects the elaboration of snacks based on frutipan or breadfruit due to its components and nutritional properties, since its fruits can be used as a replacement for rice, potato, cassava and green. On the other hand, people's preference for snack consumption generates the innovative business idea, since there is currently no product of this type of fruit in the market. The production process uses controlled raw materials, as well as manufacturing process parameters and quality control through INEN standards.

For the market study we worked in the northern sector of Quito with a population of 259,713 people. 713 people of which applying the formula for the calculation of the Fisher and Navarro sample, 383 people were obtained and then a survey was applied as an instrument through a 12-question questionnaire, from which the following aspects can be summarized: there is a 70% of people who consume snacks with a frequency of 44% in weekly consumption, giving a willingness to purchase frutipan snacks of 75% which provides the opportunity to venture into the project, in addition to the preferences of consumers in terms of presentation, distribution and price of the product, taking into consideration that consumers make the purchase decision according to the nutritional value and what they can evidence on the label of a product (Pila Tituaña & Muñoz, 2017).

Regarding the preferred places to purchase the snacks, it was determined that there would be greater acceptance if the products were distributed through supermarkets and stores, which reflects a distribution strategy. On the other hand, due to the lack of knowledge on the part of those surveyed regarding the properties of Frutipan, the results indicate that the properties and health benefits of products made with this fruit should be promoted with emphasis.

As future work, it is proposed to complement the market study with the business plan, mainly for the preparation of the financial study to determine the economic feasibility through indicators such as the internal rate of return (IRR), net present value (NPV), cost benefit,

liquidity ratios and the investment recovery period (IRP), which will be part of a degree thesis. In addition to a Focus Group to present the minimum viable product to obtain direct feedback from consumers. Finally, it is recommended to expand the market study to other geographic sectors.

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