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CEREAL BASED ON MORINGA OLEIFERA TO COMBAT CHILD MALNUTRITION IN MÉXICO

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Abstract: Nearly 52% of the Mexican population suffers from poverty, which represents 2 out of 10 in a serious state of child malnutrition, particularly when talking about the indigenous sector. The issue of the COVID 19 pandemic has aggravated the economic situation, so it is estimated that poverty will increase and, therefore, malnutrition problems. In addition to the new trends of the rest of the consumers in the market, the recent concept of cognitive health of consumers, through the demand for new product marking in the market, leads to the estimation that demand will be seriously affected towards a new trend of products with higher nutritional content. The answer to this problem may lie in the development of new alternatives for functional products with higher nutritional content that adapt to the traditional consumer culture, even in the lowest-income population strata. This document presents the market analysis, consumer profile and possible marketing strategy for the development of a cereal from *Moringa oleifera*, a plant with a large number of nutritional properties, among others, that have attracted its production in Mexico. The results obtained in the market research show that the trend and culture of cereal consumption even in the most remote indigenous areas are part of the diet based on the nutritional attributes sought by the consumer, so incorporating natural ingredients with high nutritional value to the product can help maintain good nutritional health in the various age segments of the population, especially in the children's breakfast segment where the commercial value reached MX\$6,400 million pesos in 2017 with a growth rate of 5.4% per year, which in turn represents a cultural option in the production of the cereal industry in Mexico.

Keywords: *Moringa oleifera*, malnutrition, cereal, consumption, market

Technological Innovation: Product Development

Industrial Application Area: Food Production

INTRODUCTION

Malnutrition is a consequence of poverty in countries with a certain degree of under-development, such as Mexico. This problem is most noticeable in regions where the child population is of indigenous origin, where families with limited economic resources, associated with the cultural issue of diet, are unable to complete a nutritional scheme appropriate to their stage of physical development. 43.6% of the population suffers from poverty in Mexico, which means that 4 out of 10 people are in this situation. In the child population, 2 out of 10 children under 5 years of age are in a state of malnutrition.(Miriam, 2018).

UNICEF mentions that *Moringa oleifera* offers nutritional contributions that can contribute to the solution of this problem, among other benefits that the plant offers. (UNICEF, 2017)Offering possible solutions to the issue of child malnutrition is undoubtedly an urgent task for science in Mexico, to which two research institutions, the Technological University of La Mixteca and the University of Quintana Roo, have joined forces.

This document presents the development of a cereal enriched with *Moringa oleifera*, an alternative evaluated and prototyped as a product for the national market that can contribute to reducing the problem of child malnutrition in Mexico. It corresponds to the potential market research of the project "Development of a cereal enriched with *Moringa oleifera* to combat malnutrition in children" of the call for national problems of Conacyt PN 2016/2012. Previously, it was necessary to understand the purchasing and consumption behavior of the child and family population in two regions of the country with a high degree of poverty and child malnutrition: the region where the population of Mayan origin lives in the Yucatan Peninsula in southeastern Mexico and the region of the population of Mixteca

origin in the state of Oaxaca.(Coneval, 2018), both populations with their own customs and culture, as well as other psycho-demographic traits that, associated with the geographic and climatic environment, presuppose distinctive consumption and dietary traits. Additionally, the national market was analyzed to understand the purchasing profile of consumers in general in Mexico and to be able to compare them with reference to the areas with the greatest poverty.

The above served as a basis to understand whether there are currently conditions for a potential market for the launch of a new cereal based on *Moringa oleifera* that achieves acceptance among consumers to contribute to the solution of the problem of malnutrition, and in the process reduce cholesterol levels and regulate blood sugar levels, provide energy and antioxidants, in addition to strengthening the immune system, properties that are additionally attributed to *Moringa Oleifera* (SIAP, 2018). In Mexico, 428 hectares are cultivated that produce 1,600 tons of *Moringa oleifera* in 11 municipalities in 5 states of the country, where Michoacán stands out.(SIAP, 2017).

METHODOLOGY

The physical-chemical development tests of the product prototype were carried out in the Food Science and Technology Laboratory of the Technological University of La Mixteca, which still present final prototyping adjustments based on tests. Important features to be resolved at this stage include the bitter taste and green color characteristic of *Moringa oleifera*.

The analysis of the national cereal consumption market and the profile of potential consumers of cereal based on *Moringa oleifera*, as well as its possible product marketing strategy, was carried out by the University of Quintana Roo. In this project objective, the premise to

be resolved in the first instance is the potential analysis of the cereal market in Mexico and to determine the consumption profile in Mexican families in areas with an indigenous population in extreme poverty with a degree of child malnutrition. Finally, to make comparisons with the form of consumption in the traditional urban market, to make recommendations for presentation and development of the product marketing strategy.

QUANTITATIVE RESEARCH

Quantitative research(Malhotra, 2018), aimed to quantify data on the cereal consumption culture in the indigenous area of the Mixteca of Oaxaca and the Mayan area of Quintana Roo, both with signs of child malnutrition. The data from the 437 surveys applied in both indigenous areas were subjected to statistical analysis with a confidence level of 95% and were compared with reports of cereal consumption in Mexico. (Euromonitor International, 2018).

QUALITATIVE RESEARCH

Unstructured, exploratory qualitative research was used(Malhotra, 2018), which was based on two group techniques (focus groups) with diverse characteristics (boys, girls, adolescents and mothers) to whom samples of the prototype cereal based on *Moringa oleifera* were offered with the purpose of obtaining knowledge and understanding of the context of the consumption problem. The data were processed through word association (asking the interviewees to give the first response to the stimulus words) and in-depth interviews (personal interviews that explore the interviewee's thoughts in detail).

Survey results in areas with marginalized Indigenous characteristics.The main results obtained from market research in the Mayan region of Quintana Roo and the Mixteca region of Oaxaca are the following:

Cereal consumption ratio in the study area The first thing that comes to mind when choosing a cereal for young people between 13 and 19 years old is the taste, as shown by the results of the survey applied to young people between these age ranges, secondarily they choose the nutritional value which indicates that young people choose more for the taste than for the nutritional value of the product or the price (Chart 1). The research carried out by the international market research agency Euromonitor(Euromonitor International, 2018). It is mentioned that the flavor is the main attraction of cereal for the Mexican population in general, which is consistent. Mothers, for their part, are concerned about having cereal at home without overcoming the choice of price, since it is beneficial for the health of their children due to its enriched contribution of vitamins and minerals, as reported in the qualitative research.

Preferred times for cereal consumption. In Chart 2, most respondents consider breakfast to be one of the most important meals, which is why they decide to consume cereals that provide nutritional value and are made with high-quality products during these hours of consumption. This was reported in the previous Euromonitor research. (Euromonitor International, 2018), points out that given the concern of Mexicans for their health, particularly young people, they seek to include foods that benefit them in this sense, which is why they have opted for the consumption of cereals for breakfast. In this case, a nutritional cereal with additional functional characteristics in food.

Preferred place of purchase of cereals in the study area. Chart 3 shows the respondents' preference for where to buy cereal. They most often chose corner stores or grocery stores for their cereal purchases, particularly choosing the Kellogg's brand, which may mean that, as it is a well-positioned brand, it

has a distribution system that covers any type of place for its sale. According to research by Euromonitor(Euromonitor International, 2018), Kellogg's was shown to be the market leading brand in Mexico.

Determinant of purchase choice and cereal prices that consumers are willing to pay. In Chart 4, it can be observed that the majority of respondents consider that the one who determines the purchase of cereal in their home is the mother, since she is the one who shows interest in the nutritional aspects of her family. Mothers are willing to pay on average within a range of \$20 to \$40 pesos per box of cereal, however, it depends a lot on the purchase option offered, since in marginalized rural communities you can buy small plastic bags filled in bulk for which you pay from \$3 to \$19 pesos, or you can buy the medium or large box of cereal in a supermarket or mini-supermarket paying between \$40 and \$80 pesos or more depending on the ability to pay. Cereal consumption in the diet of families in marginalized areas of Quintana Roo and the Mayan zone is 98% of families, the remaining 2% is due to lack of income.

ANALYSIS OF THE CEREAL CONSUMPTION MARKET IN RELATION TO INTEREST IN MORINGA OLEIFERA IN MEXICO, 2020. IMPACT OF THE COVID 19 PANDEMIC

2020 was undoubtedly an extraordinary year due to the COVID-19 pandemic, which still has consequences today. There are many effects and what they cause in human beings. In Mexico, the interest in surviving the pandemic and restoring the current economic situation as soon as possible has modified the codes of conduct in food consumption.

The economic impact of unemployment has led to major changes in the way people eat, with cereal consumption increasing by

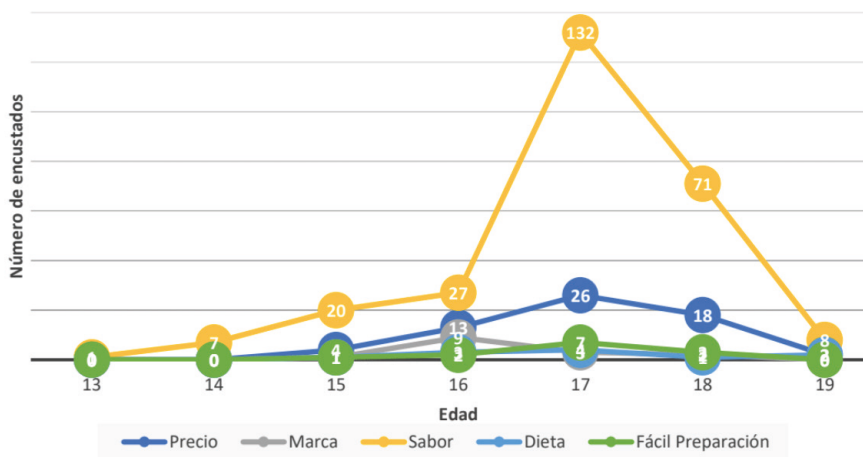


Figure1 Cereal consumption rate among young people in the study areas
Source: own elaboration.

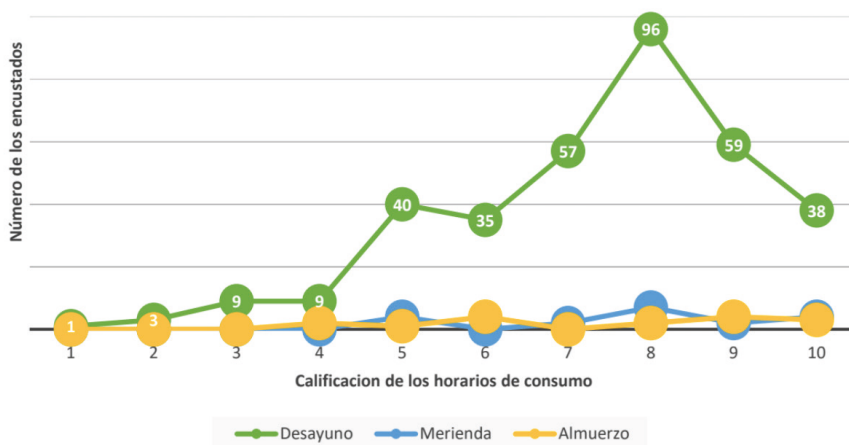


Figure 2. Preferred consumption time for cereals Based on a survey in the Mayan zone and the Mixteca zone
Source: own elaboration.

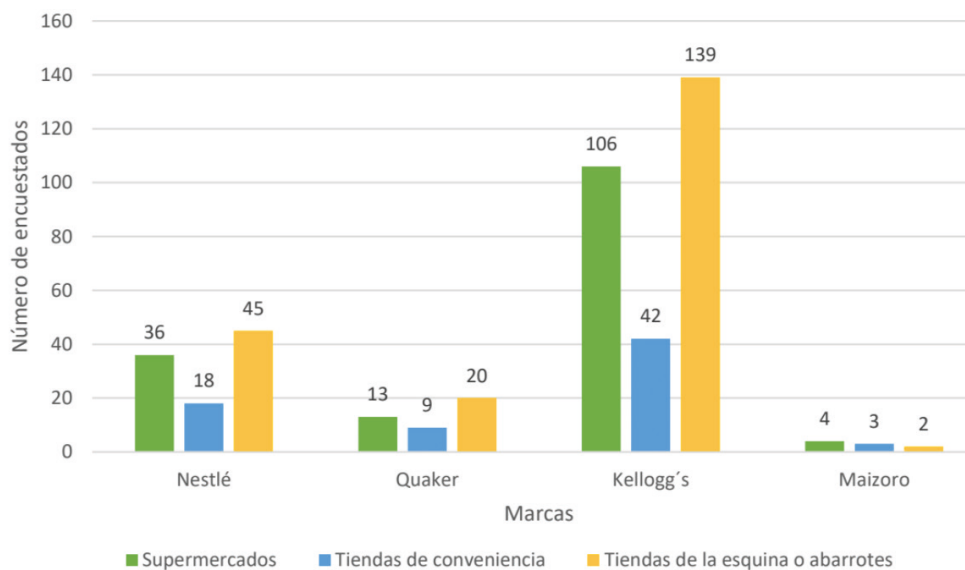


Figure 3. Preference for place of purchase and commercial brands of cereals
Source: own elaboration.

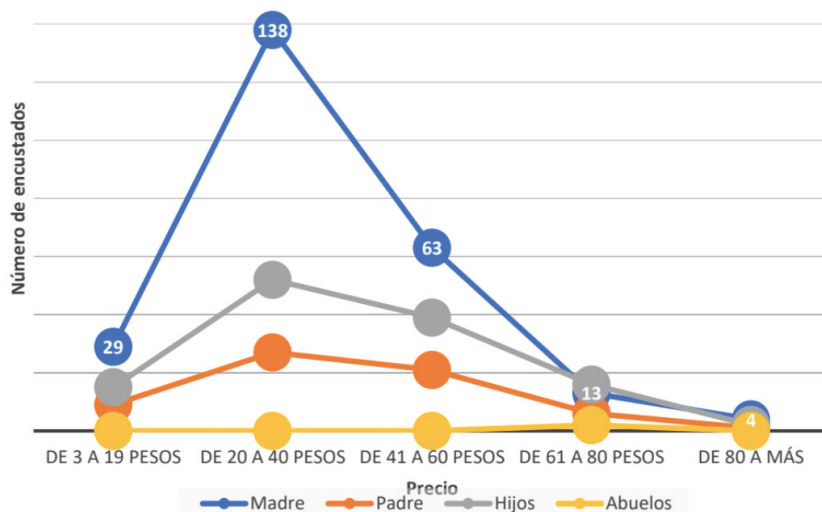


Figure 4. Who chooses to purchase cereal at home and willingness to pay the price.

Source: own elaboration.

up to 11% while meat and other select, more expensive foods have decreased in families' diets. In addition, in the poorest regions, this economic situation has had a negative impact on the health of children, where child malnutrition has increased to an estimated 55% at the beginning of 2020.(Itandehui Castro Quezada, 2020).

While the Covid-19 issue increased interest in strengthening health, it also impacted interest in learning about *Moringa oleifera*, which was linked to the search terms of heads of households as a possible remedy to improve the immune system. However, this was temporary and for a very short period, since there was no way to prove in the short term any possible benefit beyond improving nutrition, interest in *Moringa oleifera* declined shortly after 4 months and even marked a sharp drop in general interest over the years.

The interest in cereal consumption is going in the opposite direction to that of *Moringa oleifera*, showing a constant increase in recent years. This interest in consuming cereals increased significantly during the beginning of the pandemic to such an extent that distribution centers emptied their warehouses, displacing the production capacity of suppliers by up to 56% according to a Euromonitor report.

(Euromonitor International, 2020)(Figure 5).

The trend in cereal consumption in Mexico will continue to grow at an exponential rate of between 5.6% and 11% (Figure 6). Preferences in flavor and brands will remain, although price increases are expected (Figure 7) that may impact demand, coupled with the slow recovery of jobs not only in terms of number, but also in terms of the economic level of perceptions that existed before the COVID 19 Pandemic.

CONCLUSIONS

Euromonitor International reports show a 5% increase in cereal consumption since 2017. This increase in consumption was due to the implementation of cereals with more nutritional ingredients, adding more vitamins and minerals to them, satisfying the demand of the market that has become increasingly demanding in terms of the consumption of healthier and more nutritional foods. Mexico is one of the countries where consumers are changing their lifestyles in terms of their diet and health care.(Euromonitor International, 2018, pp. 1-3)

The research carried out in the rural sector in this project shows the same results obtained from the surveys as those presented by Euromonitor (2018), regarding the existing

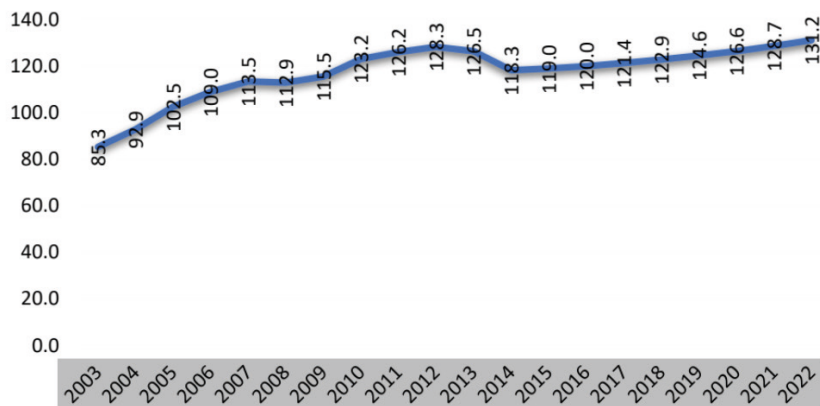


Fig 5 Cereal Consumption trend in México 2003-2022 (tons)

Source: own elaboration.

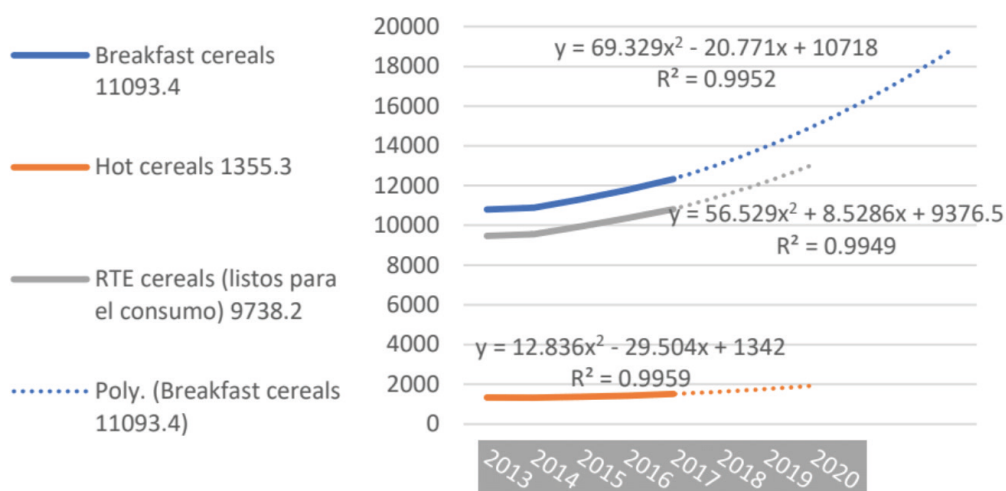


Fig 6 Cereals sales projection by categories 2012-2017

Source: own elaboration.

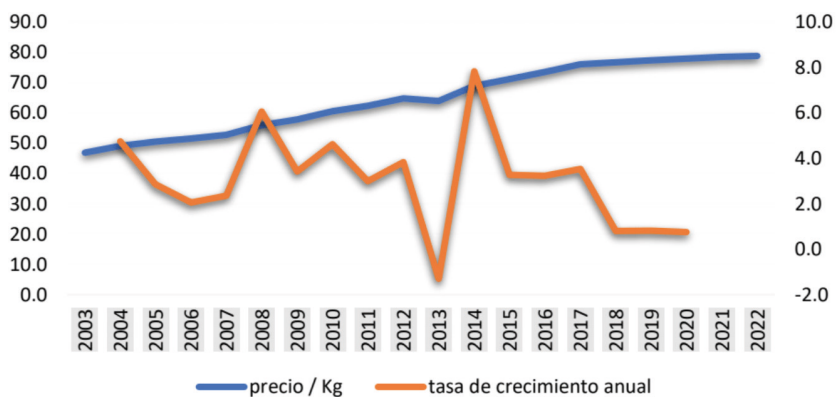


Fig 7 Evolution of average prices per kilogram of cereals 2003-2022

Source: Own elaboration

demand for nutritional products, in this case a cereal based on *Moringa oleifera*. The above leads us to conclude that, based on the results of the 437 surveys applied to young people in rural areas, the same trend was obtained as in urban areas, so there is a potential market for the consumption of a new cereal that meets the characteristics of current trends and satisfies the needs of demand. Therefore, the creation of a new cereal with nutritional characteristics with *Moringa oleifera* as a key ingredient is feasible.

FINDINGS AND MARKET CONDITIONS

It is important to mention that consumers have a less than positive perception about *Moringa*, since most people consider it a healthy product instead of a nutritional one, and others consider it dangerous for consumption since they are unaware of its attributes. Therefore, it can be a negative aspect when marketing a product that has this component as an ingredient. Leaving this perception aside, there are conditions that mothers are willing to accept in case of making the new cereal, which are the flavor, color, consistency and, as it is well known, cereals are not 100% natural. What this specific segment is looking for is to buy a cereal that really has all the attributes

that are mentioned and advertised. Therefore, a cereal made of corn flour flakes, wheat, oats and *Moringa oleifera* leaf flour, covered in chocolate flavor is feasible.

With the results of the field research and the consultation of market reports, the feasible strategy was designed to carry out the commercialization of said product based on the marketing mix strategy. These strategies result in children not looking for what a cereal contains in the box, such as the nutritional attributes, but rather they always look for flavor as the main attribute in a cereal, they like to find gifts and games in its designs and identifying with the characters on the packaging. For their part, mothers always observe the nutritional value contained in a box of cereal, they always look for the nutritional table, to make sure that they are 100% healthy.

The conclusion of this research demonstrates the market feasibility of developing a new cereal based on *Moringa oleifera*, provided that market demands are met. However, it is important to mention that, regarding combating child malnutrition, there are barriers to solving the problem, which are mainly the indigenous culture in rural areas, since traditionally there are breakfast substitute foods that are very different from cereals depending on the region or rural area.

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