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ABSTRACT

This research is carried out to answer the question: Is the production and marketing of dehydrated lupine (*Lupinus mutabilis*) feasible in the city of Guaranda? This approach is answered by developing a hypothetical-deductive research methodology, with a quantitative approach; which is carried out through a documentary bibliographic analysis and a "non-experimental" field work, which includes the application of a survey and the nutritional analysis of dehydrated lupine in a laboratory. The object of study is the population of Guaranda, from which a sample of 384 people was drawn, considering a confidence level of 95% and a margin of error of 5%. The results of this work allow the research to be carried out at a descriptive and exploratory level, which allows demonstrating the commercial acceptance of the lupine in the population under study, the nutritional contribution of the lupine, and finally, the elaboration of a business plan that promotes the production and product marketing. By meeting these objectives, it is concluded that there is a predisposition to the consumption of dehydrated lupine among the population of the city of Guaranda, mainly in young people aged 12 to 17 who live in urban areas. Also, it can be affirmed that the dehydrated lupine is a product whose nutritional contribution is 100% natural, and is made up of nutrients totally free of gluten and preservatives, capable of generating 2000 calories in 15 gr of the product.

Keywords: Lupine dehydrated, feasibility, nutritional contribution, and business plan.

INTRODUCTION

The production of dehydrated lupine emerges as an innovative option, in a context in which the world requires solutions for a healthy diet. The immense nutritional qualities of the lupine, as well as its high acceptance in the market, mainly in the mountains, open up possibilities for its production and commercial distribution (Silva Arellano, 2020).

Lupine or *Lupinus/Lupino*, tricolor (*Lupinus mutabilis*), better known as chocho in the Andean countries, is a legume with high nutritional value, especially protein (Romero, 2020).

Lupine grain morphology

The lupine, *Lupinus mutabilis* sweet has many nutritional characteristics, in dry grain it contains 42% protein thanks to the presence of quinolizidine alkaloids, but in the debittering process it eliminates the alkaloids allowing to concentrate the protein content to 51% in dry grain (Poveda, 2020).

The oil content in lupine is (18% - 21%), predominantly fatty acids such as oleic acid 40,40%. In the stimulation of gastrointestinal hormones, lupine has favorable digestive effects; 37,10% linoleic acid that apart from representing an energy contribution has properties that make it unique and irreplaceable in the most difficult stages of development; and Linoleic 2,90%, also contains phosphorus that works as a controller of the bone system; iron at 78,45 ppm, is a basic mineral for the production of hemoglobin, oxygen transport and increased resistance to diseases (Poveda, 2020).

Antioxidant capacity

Lupine seeds contain polyphenols, phytosterols and squalene (triterpene) when compared to other legumes. In lupine, flavonoids predominate over phenolic acids, with the reverse occurring in other lupine species, showing a higher content of total phenols. Commercial lupines grown in the same season and location in Australia have total polyphenols between 1,6 and 1,9 mg•g⁻¹ dry weight, expressed as gallic acid equivalents (GAE) and a total antioxidant content between 2,6 and 5,4 μmol Trolox Equivalents (TE)•g⁻¹ dry weight (Karamać, 2018).

Lupine derived products

In the Andean areas, lupine is highly consumed, especially by mothers who are breastfeeding and children who are in their development process, additionally controlling diseases such as diabetes, gout, etc., as it is a substitute for animal protein (Asociación, 2016).

METODOLOGY

Research type and design

The present work is carried out to determine the feasibility for the production and commercialization of dehydrated lupine in the city of Guaranda; that is, it is a practical application of knowledge related to agribusiness. Therefore, the research is "applied"

Analysis of raw material

The physical chemical analyzes of the dehydrated lupine were the following: Moisture Analysis (under the INEN 1676 standard), Fat (under the AOAC2003.06 standard), Ash (AOAC, 923.03, 1990) and Calcium (AOAC method 985.35, 1997).

Deductive hypothetical methodology

The hypothetical deductive methodology was applied where data collection instruments were used in order to collect the information that was later analyzed through statistical processes (Del Cid, Méndez, & Sandoval, 2007).

Quantitative approach

The quantitative approach of this research implies a deep bibliographical analysis. Therefore, the modality is "bibliographic - documentary". This is "a strategy of understanding and analysis of theoretical or empirical realities through the review, collation, comparison or understanding of different types of documentary sources referring to a specific topic, through a systematic and organized approach" (Uriarte, 2020).

Population and sample

According to the "Territorial Planning Plan of the Decentralized Autonomous Government of the Guaranda Canton", a population of 108.763 inhabitants is estimated for 2020 (Gobierno Autónomo Descentralizado del Cantón Guaranda, 2020). This being the study population. With an error of 5% and a 95% confidence level, a sample size of 384 people is established, which was calculated with the following mathematical model:

$$n = \frac{Z^2 \times p \times (1 - p)}{e^2}$$

Data collection techniques and instruments

The non-experimental design of the research is carried out through a survey applied by simple random sampling (probabilistic). The age of the respondents is between 12 to 65 years. The survey is conceived as a market investigation, that is, the data collection seeks to obtain the necessary information to demonstrate the feasibility for the processing and commercialization of dehydrated lupine in the city of Guaranda. The data collection instrument is a questionnaire made up of 11 questions, divided into 3 blocks.

The first block corresponds to demographic information and consists of 4 items:

Gender of the respondent, Area where the respondent lives, Activity to which the respondent is engaged.

The second block is related to the consumption of lupine and is made up of 3 items: Have you eaten lupine? Do you like lupine? How often do you eat lupine? The third block refers to the predisposition to purchase and has 4 questions:

Would you try dehydrated lupine? Would you buy dehydrated lupine? Should the presentation of dehydrated lupine contain grams? How much would you pay for this cover?

Procedure for data collection

The procedure for data collection consists of the following steps:

- Preparation of the data collection instrument (questionnaire).
- Application of the data collection instrument through simple random sampling.
- Creation of a statistical database in SPSS software.
- Information processing and analysis.

RESULTS

Physical chemical analysis of dehydrated lupine

Moisture Analysis: 5,93; Fat Analysis: 0.03507, Ash: 1,97; Calcium: 1.836,47 (%)

Descriptive analysis

Question 1

Gender of respondents

After sampling, it was proven that the population is made up of 52,8% women and 47,2% men. This is consistent with the official figures given by the INEC (2010) in the latest Population and Housing Census, which shows 51,7% women and 48,3% men.

Question 2

Area where the respondent lives

The result of the sampling proves that 75,6% of the population comes from the urban area, while 12,6% is from the rural area and 11,8% from the marginal urban area. This indicates that the market study was concentrated in the urban area of the city of Guaranda.

Question 3

Activity to which the respondent is engaged

The result of the sampling proves that 27,4% of the population is made up of students; 23,1% by merchants; 31,5% are people with stable work; 5,6% are artisans; 3,6% retired; 2,8% are carriers; 2,6% are farmers or ranchers and 3,3% are unemployed. In general terms, 82,1% of the possible target market is made up of students, merchants and people with stable jobs.

Question 4

Consumption of pussies

The result of the sampling proves that 99% of the population has consumed lupine at some time. This indicates that lupine is a food that is part of the culinary culture of the city of Guaranda.

Question 5

Taste for lupine

The result of the sampling shows that 95,4% of the population likes lupine, 3,6% does not like it, and 1% of missing values correspond to people who have never eaten lupine. In turn, 96,4% of the people who have eaten lupine do like it. These data show that there is a high acceptance of lupine in the culinary tastes of the people of Guaranda.

Question 6

Lupine consumption frequency

Considering that there are 18 people who have not consumed or do not like lupine, the result of the sampling shows that 13,2% of the population consume lupine daily, 54,8% weekly, 21% fortnightly and 11% monthly. There is a high frequency of consumption of lupine, since 68% of potential customers eat lupine at least once a week.

Question 7

Predisposition to buy dehydrated lupine

Considering that there are 47 people who have not consumed or do not like lupine, or in turn, are not willing to try dehydrated lupine. The result of the sampling proves that 0,9% of the population that is predisposed to try dehydrated lupine would not buy it; while 99,1% say yes. There is a high predisposition of potential customers to buy dehydrated lupine.

Question 8

Preference for the amount of dehydrated lupine in each presentation

Considering that there are 50 people who have not consumed or do not like lupine, or in turn, are not willing to try or buy dehydrated lupine. The result of the sampling proves that 42,6% prefer presentations of 30 gr, 43,8% of 50 gr, 12,6% of 100 gr and 0,9% other quantities. Considering the margin of error of 5%, considered for the calculation of the sample, it can be said that there is an equal number of potential clients who prefer presentations of 30 gr and 50 gr. These presentations demonstrate a marked trend that represents 86,5% of those surveyed.

DISCUSSION

There is a predisposition to the consumption of dehydrated lupine among the population of the city of Guaranda, therefore, its production could be profitable with a well-structured business plan.

This acceptance of the product is linked to demographic aspects that define the profile of potential customers. The results of the survey and the hypothesis tests allow us to determine that the dehydrated lupine has

commercial acceptance among the population that lives in the urban area of the city, without distinction of gender or occupation; however, there is a higher frequency of lupine consumption among the population aged 12 to 17 years. Finally, potential customers are willing to pay \$1 for dehydrated lupine in a 30 g presentation, up to \$2,50 for a 50 g presentation, and up to \$3,50 for a \$100 g package.

- According to the results obtained in the laboratory study and the theoretical evidence presented in the bibliographical analysis, dehydrated lupine is a product whose nutritional contribution is 100% natural, and is made up of nutrients totally free of gluten and preservatives. Percent Daily Values are based on a 2000 calorie diet in 15 g of the product. These can vary depending on the caloric needs of the consumer.
- To reduce the risk of loss in the production and marketing of the product, it is necessary to prepare a business plan that defines the sales strategies and the financial scope of the investment project. This plan is presented in the section on presentation and publication of the results.

Dehydrated lupine business plan

Investment plan

This would be the investment plan to be used in the project, the total investment would be USD. 42,000.00:

Table 1:Investment plan

Description	Valor USD.	Quantity	Total USD
Drying machine - cleaning - classification	\$ 12.000,00	1	\$ 12.000,00
sleeve	\$ 2.000,00	1	\$ 2.000,00
Truck	\$ 24.000,00	1	\$ 24.000,00
Furniture and fixtures	\$ 1.500,00	1	\$ 1.500,00
Office team	\$ 1.000,00	1	\$ 1.000,00
Computing team	\$ 500,00	3	\$ 1.500,00
TOTAL			\$ 42.000,00

The fixed assets depreciation table is also attached:

Product

The products to be produced are listed below:

Table 2:Product

Concept
30 g bag of dried lupine
50 g bag of dried lupine
100 g bag of dried lupine

Price

The price at which the product will be sold will be as follows, based on the willingness to pay obtained in the survey:

Table 3:Sales

Concept	Monthly Units	Price	% waste	Sold units	Monthly Total	Total annual
30 g bag of dried lupine	5.000	\$1,00	5%	4750	\$ 4.750,00	\$ 57.000,00
50 g bag of dried lupine	500	\$ 2,00	5%	475	\$ 950,00	\$ 11.400,00
100 g bag of dried lupine	50	\$ 2,50	5%	48	\$ 118,75	\$ 1.425,00
			Total		\$ 5.818,75	\$ 69.825,00

Place

The area of influence is the province of Bolívar.

Costs and expenses

The costs and expenses of the project will be the following:

Table 4: Costs and expenses

Concept	Monthly Total	Total annual
Direct materials	\$ 207,00	\$ 2.484,00
Indirect materials	\$ 51,70	\$ 620,40
Contingencies	\$ 505,00	\$ 6.060,00
Direct labor	\$ 1.784,79	\$ 21.417,48
Administrative expenses	\$ 1.328,36	\$ 15.940,32
Selling expenses	\$ 921,13	\$ 11.053,56
Financial expenses	\$ 372,43	\$ 4.469,16
Depreciation	\$ 579,17	\$ 6.950,04
Total	\$ 5749,58	\$ 68.994,96

Amortization

The project will be financed with a loan from the Public Bank (CFN), based on the following policy:

Table 5: Financing conditions

Concept	
Amount	USD. 29.400,00
Term	10 años
Interest rate	9%
Quota	USD. 372,43

Cash flow

Based on cash income and expenses, a 10-year flow is projected where it is always positive, that is, cash income is greater than expenses, so the project does not need a short-term injection of liquidity; s say is financially self-sustaining:

Table 6: Balance Projected at 10 years

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Operating income	69.825,00	71.919,75	74.077,34	76.299,66	78.588,65
30 g bag of dried lupine	57.000,00	58.710,00	60.471,30	62.285,44	64.154,00
50 g bag of dried lupine	11.400,00	11.742,00	12.094,26	12.457,09	12.830,80
100 g bag of dried lupine	1.425,00	1.467,75	1.511,78	1.557,14	1.603,85
Operating expenses	57.575,7	58.727,3	59.901,8	61.099,8	62.321,8
Direct materials	2.484,0	2.533,7	2.584,4	2.636,0	2.688,8
Indirect materials	620,3	632,7	645,4	658,3	671,5
Contingencies	6.060,0	6.181,2	6.304,8	6.430,9	6.559,5
Direct labor	21.417,5	21.845,9	22.282,8	22.728,4	23.183,0
Administrative expenses	15.940,3	16.259,1	16.584,3	16.916,0	17.254,3
Selling expenses	11.053,6	11.274,7	11.500,2	11.730,2	11.964,8
Operating cash flow	12.249,3	13.192,5	14.175,5	15.199,8	16.266,8
Interest and taxes	595,2	839,7	1.096,5	1.505,6	1.758,8
Investment	0,0	0,0	0,0	0,0	0,0
Financial Expense	4.469,12	4.469,12	4.469,12	4.469,12	4.469,12
Payment of long-term financial obligations	1.900,2	2.078,5	2.273,5	2.486,7	2.720,0
Financial expenses (interest)	2.568,9	2.390,6	2.195,7	1.982,4	1.749,1
Non-operational cash flow	7.184,9	7.883,7	8.609,9	9.225,1	10.038,9

Table 7:Balance Projected at 10 years

Concept	Year 6	Year 7	Year 8	Year 9	Year 10
Operating income	80.946,31	83.374,70	85.875,94	88.452,22	91.105,79
30 g bag of dried lupine	66.078,62	68.060,98	70.102,81	72.205,89	74.372,07
50 g bag of dried lupine	13.215,72	13.612,20	14.020,56	14.441,18	14.874,41
100 g bag of dried lupine	1.651,97	1.701,52	1.752,57	1.805,15	1.859,30
Operating expenses	63.568,3	64.839,6	66.136,4	67.459,2	68.808,3
Direct materials	2.742,5	2.797,4	2.853,3	2.910,4	2.968,6
Indirect materials	684,9	698,6	712,6	726,8	741,4
Contingencies	6.690,7	6.824,5	6.961,0	7.100,3	7.242,3
Direct labor	23.646,7	24.119,6	24.602,0	25.094,0	25.595,9
Administrative expenses	17.599,4	17.951,4	18.310,4	18.676,6	19.050,1
Selling expenses	12.204,1	12.448,1	12.697,1	12.951,1	13.210,1
Operating cash flow	17.378,0	18.535,1	19.739,5	20.993,1	22.297,4
Interest and taxes	3.103,0	3.416,1	3.745,2	4.091,3	4.455,3
Financial Expense	4.469,12	4.469,12	4.469,12	4.469,12	4.469,12
Payment of long-term financial obligations	2.975,2	3.254,3	3.559,5	3.893,4	4.258,7
Financial expenses (interest)	1.494,0	1.214,9	909,6	575,7	210,5
Non-operational cash flow	9.805,9	10.649,8	11.525,2	12.432,7	13.373,1

Statement of income

The projected income statement presents utility in all years; with which it is interpreted that the project is viable from the financial point of view, it works with an assumption of sales growth of 3% per year and 2% in what corresponds to costs and expenses.

Table 8:Income Statement at 10 years

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
SALES	69.825,0	71.919,8	74.077,3	76.299,7	78.588,7
MANUFACTURING COSTS	37.531,8	38.143,5	38.767,3	38.764,7	39.552,8
MATERIALS	2.484,0	2.533,7	2.584,4	2.636,0	2.688,8
WORKFORCE	21.417,5	21.845,9	22.282,8	22.728,4	23.183,0
CIF	13.630,3	13.763,9	13.900,2	13.400,2	13.681,0
ADMINISTRATIVE EXPENSES	15.940,3	16.259,1	16.584,3	16.916,0	17.254,3
SELLING EXPENSES	11.053,6	11.274,7	11.500,2	11.730,2	11.964,8
FINANCIAL EXPENSES	2.568,9	2.390,6	2.195,7	1.982,4	1.749,1
= PROFIT BEFORE IMP. AND UTILITIES	2.730,4	3.851,9	5.029,9	6.906,4	8.067,7
UTILITIES 15%	409,6	577,8	754,5	1.036,0	1.210,2
IMP RTA 8%	185,7	261,9	342,0	469,6	548,6
NET PROFIT	2.135,2	3.012,2	3.933,4	5.400,8	6.308,9

Table 9:Income Statement at 10 years

Concept	Year 6	Year 7	Year 8	Year 9	Year 10
SALES	80.946,3	83.374,7	85.875,9	88.452,2	91.105,8
MANUFACTURING COSTS	35.414,8	36.090,1	36.778,9	37.481,5	38.198,1
MATERIALS	2.742,5	2.797,4	2.853,3	2.910,4	2.968,6
WORKFORCE	23.646,7	24.119,6	24.602,0	25.094,0	25.595,9
CIF	9.025,6	9.173,1	9.323,6	9.477,1	9.633,6
ADMINISTRATIVE EXPENSES	17.599,4	17.951,4	18.310,4	18.676,6	19.050,1
SELLING EXPENSES	12.204,1	12.448,1	12.697,1	12.951,1	13.210,1
FINANCIAL EXPENSES	1.494,0	1.214,9	909,6	575,7	210,5
= PROFIT BEFORE IMP. AND UTILITIES	14.234,1	15.670,2	17.179,9	18.767,4	20.437,0
UTILITIES 15%	2.135,1	2.350,5	2.577,0	2.815,1	3.065,5
IMP RTA 8%	967,9	1.065,6	1.168,2	1.276,2	1.389,7
NET PROFIT	11.131,1	12.254,1	13.434,7	14.676,1	15.981,7

Financial indicators

The table of financial indicators is attached, taking into account a 9% opportunity cost (the value of the interest rate); and in all financial ratios we obtain positive data; the NPV amounts to USD. 19,765 and the IRR of 33%; under these financial reasons, it is determined that the project is viable since the investment is recovered and it also generates profits, even with a percentage of 70% credit of the total project.

Table 10: Financial indicators

Concept	Year 1	Year 2	Year 3	Year 4	Year 5
Current liquidity	4,8	4,7	4,6	4,5	4,4
Acid test	3,8	3,8	3,8	3,7	3,7
Asset indebtedness	0,7	0,7	0,8	0,9	1,0
Endeudamiento patrimonial	2,0	2,6	4,0	8,4	32,1
Fixed Asset Indebtedness	0,4	0,4	0,3	0,2	0,1
Appeceament	3,0	3,6	5,0	9,4	33,1
Financial appeceament	2,3	2,9	3,9	7,4	25,9
Portfolio rotation	32,4	29,5	27,0	25,2	23,2
Fixed Asset Rotation	2,0	2,5	3,3	4,8	7,5
Sales Rotation	1,6	1,8	2,2	2,7	3,3
Average Collection Period	11,3	12,4	13,5	14,5	15,7
Impact Administrative Expenses and Sales	0,27	0,26	0,25	0,25	0,24
Financial burden impact	0,037	0,033	0,030	0,026	0,022
Net Return on Assets	0,05	0,08	0,12	0,21	0,30
gross margin	0,462	0,470	0,477	0,492	0,497
Operating Margin	0,04	0,05	0,07	0,09	0,10
Net Profitability of Sales	0,031	0,042	0,053	0,071	0,080

Table 11: Financial indicators

Concept	Year 6	Year 7 Año 7	Year 8 Año 8	Year 9 Año 9	Year 10 Año 10
Current liquidity	4,0	3,9	3,8	3,8	3,7
Acid test	3,3	3,3	3,2	3,2	3,1
Asset indebtedness	1,0	0,85	0,69	0,50	0,26
Endeudamiento patrimonial	34,4	5,5	2,2	1,0	0,3
Fixed Asset Indebtedness	0,1	0,6	1,6	4,9	12,3
Appeceament	35,4	6,5	3,2	2,0	1,3
Financial appeceament	27,7	5,1	2,5	1,6	1,1
Portfolio rotation	23,7	21,9	20,2	18,7	17,4
Fixed Asset Rotation	10,6	14,1	21,2	42,3	69,8
Sales Rotation	3,8	3,9	4,1	4,3	4,2
Average Collection Period	15,4	16,7	18,1	19,5	21,0
Impact Administrative Expenses and Sales	0,24	0,23	0,22	0,22	0,21
Financial burden impact	0,018	0,015	0,011	0,007	0,002
Net Return on Assets	0,60	0,69	0,79	0,90	0,96
gross margin	0,562	0,567	0,572	0,576	0,581
Operating Margin	0,18	0,19	0,20	0,21	0,22
Net Profitability of Sales	0,138	0,147	0,156	0,166	0,175

Table 12: Return indicators

Concepto	
VAN	\$19.765,65
TIR	33%

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