Research Journal of Applied Sciences 14 (1): 16-20, 2019
ISSN: 1815-932X

Improvement of the Nutritional Value of Manjar De Leche by Adding Different Types of Flours and Sweeteners

[1]Ivan Garcia-Caceres, [2]Angelica Tigre, [1, 2]Favian Bayas-Morejon, [3]Maria Morejon,
[3]Danilo Yanez, [1]Moises Arreguin, [1, 2]Oderay Merino, [1]Marcelo Garcia, [3]Ivan Moreno,
[1]Sonia Salazar, [3]Franco Cordero and [1]Danilo Montero
[1]Facultad de Ciencias Agropecuarias, Recursos Naturales y del Ambiente,
Carrera de Ingenieria Agroindustrial,
[2]Centro de Investigacion y Desarrollo Biotecnologico, Departamento de Investigacion,
[3]Facultad de Ciencias Agropecuarias, Recursos Naturales y del Ambiente,
Carrera de Medicina Veterinaria y Zootecnia, Universidad Estatal de Bolivar,
CP: 020150 Guaranda, Ecuador

Abstract: In the present investigation he aimed at, elaborate Manjar de leche and its improvement of the nutritional value by adding different kinds of flour and sweeteners. The Design of Blocks Completely Random (DBCA) with factorial arrangement A×B, 3×3×3 was applied. The functional analysis was based on the Tukey test at 5% for average treatments. When applying the evaluation of the organoleptic characteristics of the attributes, color, smell, taste, acceptability and to compare the treatments, the panelists determined as best treatment the T1 (A_1B_1) that corresponded to (Panela 900+Lupine 150 g). In which the following data stand out, chemical physicist who noted an increase in titratable acidity (lactic acid) from 0.30-0.36, this was due to the fact that it was made with sweetener panela and lupine flour 31.61% humidity retention by sweeteners and pectin in the bromatological analysis an important protein increase of 5.0-6.73% and ash reduction of 2.5-2.40% was obtained which is clear indication that the product raised its nutritional value; On the other hand, microbiological analyzes found a total absence of microorganisms, so, the product, besides being highly nutritious, met all the standards required for consumption.

Key words: Nutritional value, Manjar de leche, flours, sweeteners, microorganisms, highly nutritious

INTRODUCTION

Milk is the only food whose exclusive and animal purpose is to serve as such; It has a balanced composition of nutrients, both in sugars, fat and proteins, as in micronutrients, minerals, vitamins and amino acids. Cow's milk is the most important food in humanity, reaching the year 1998 a consumption of 550.000,000 tons worldwide (91.6 kg per inhabitant) and expected consumption of 654.000,000 tons by 2020 with 85 kg per inhabitant (INEN, 2009, 2011). It is an unstable and perishable product that is rapidly altered which is why it is subject to strong regulation and control (Brito, 2008).

However, it is possible to improve the quality of this food product, using special substrates that are within the reach of the producer, such as flour (corn, lupine, quinoa) which represent thickeners of easy and rapid transformation with use of the characteristics of coagulation with less risk of precipitation and formation of lumps and crystallization of sugars which can be achieved to improve more than the chemical composition characteristics, the particularities of texture, brightness, taste and increase the nutritional value, as a consequence of important transformation reactions due to cooking, uniform dehydration and desirable physical changes (Multon, 2008).

Taking advantage also of the benefits of sugar, within a balanced diet, they produce a sensation of pleasure beneficial to the mind. When it is restricted, a kind of anxiety crisis is generated and high degrees of frustration accumulate which can even lead to psychiatric problems such as bulimia and anorexia. Consuming at least one sweet a day will allow to maintain regulated levels of anxiety and not fall into excesses. The body responds better to foods with natural sugars than artificial sweeteners.

In the present research work, the following objective was established: to establish the best kind of flour (lupine, quinoa, corn) and sweetener (panela, sugar and honey) in the elaboration of milk delicacy (Anonymous, 2011).

Corresponding Author: Favian Bayas-Morejon, Facultad de Ciencias Agropecuarias, Recursos Naturales y del Ambiente, Carrera de Ingenieria Agroindustrial, Universidad Estatal de Bolivar, CP: 020150 Guaranda, Ecuador

Table 1: Combination of factors

Treatments	Code	Detail
1	A_1B_1	Panela 900+Lupine flour 150 g
2	A_1B_2	Panela 900+Corn flour 150 g
3	A_1B_3	Panela 900+Quinoa flour 150 g
4	A_2B_1	Zugar 900+Lupine flour 150 g
5	A_2B_2	Zugar 900+Corn flour 150 g
6	A_2B_3	Zugar 900+Quinoa flour 150 g
7	A_3B_1	Honey 900+Lupine flour 150 g
8	A_3B_2	Honey 900+Corn flour 150 g
9	A_3B_3	Honey 900+Quinoa flour 150 g

A completely randomized block design was applied with factorial arrangement A×B 3×3×3

MATERIALS AND METHODS

The present research was carried out in the dairy plant of the carrera de Ingenieria Agroindustrial of the Universidad Estatal de Bolivar in Guaranda (Ecuador).

The study factors used in this research were: factor A (three types of sweeteners "panela, sugar and honey"); Factor B (three kinds of flours "lupine, corn and quinoa") in Table 1 the combination of factors is shown.

Methods and data to be evaluated: In the milk, analyzes were made of: NTE INEN 11, NTE INEN 12, Acid NTE INEN 13, NTE INEN 018 reductase, NTE INEN 14 total solids, NTE-INEN 1500 alcohol test.

On the other hand, in the flours (lupine, quinoa, corn) were carried out analyzes of: humidity according to, the INEN 518 standard, ashes in accordance with the INEN 520 standard. Finally, in the Manjar de leche analyzes were carried out; Density, titratable acidity (°D), Brix degrees (°Brix) and hydrogen potential (pH) according to the FAO and UNE EN ISO 9001. Also, the organoleptic analysis of the manjar was carried out, to determine color, odor, flavor and acceptability according to, the hedonic scale of Wittig. For which there were 10 semi-trained tasters. The evaluation parameters were: 1: bad, 2: regular, 3: good, 4: very good and 5: excellent (from this analysis the best treatment was obtained).

Analysis in the best treatment: The nutritional evaluation of the best treatment was carried out for which analysis were made of: protein content (Fil20: B, 1993),dry matter P.S.M (dry weight of the sample), ashes INEN 014 and humidity INEN 700. Also, microbiological count analyzes were performed to: Escherichia colicount (Edict of Government, 1973a, b), Fungi and yeasts count (Edict of Government, 1981a, b).

Experiment management

Reception of milk: The milk was received from the Toni Bolivar S.A., collection center to which quality parameters were measured such as density, fat and total solids, alcohol test, reductase test or microbial load.

Filtration: It was made by using a fine mesh towards the kettle and it was pasteurized at 45°C for 5 min, then 2 g of bicarbonate was added.

Concentrated: This was through the addition of panelaand honey which were pasteurized (in the case of sugar does not pasteurization was required), the addition was: 900 g of sweetener in 2000 mL of milk at 45°C in agitation for 5 min. The constant homogenization prevented the sweet and fat from adhering to the walls of the container, at 60°C for 45 min, the flour (lupine, corn and quinoa) was added. Finally, 2 g of pectin was added to the process until it reached 75°C. The evaporation time required for the product to finish its process was 1 h and was determined by the refractometer analysis at 65°Brix.

Cooling: It was carried out in a water bath and reduced to 50°C.

Packaging: The packaging was carried out at 50°C, this temperature allowed an easy flow and sliding in flasks, avoiding the appearance of fungi.

Statistical analysis: A statistical analysis of comparison of means of Tukey was performed for which the statistical Software InfoStat was used.

RESULTS AND DISCUSSION

Proximal milk results: For the density in the raw material (milk) a value of 1,029 g/cm^3 was obtained and according to the norm (Edict of Government, 1981a, b) it must have a range between 1,028-1,032 g/cm^3 for therefore, the values that govern the norm are met, so that, the milk has not been altered in its constitution (Zaragoza and Acribia, 2011).

Regarding the fat content, this was 5.5% and according to the standard (Edict of Government, 1981a, b) a minimum of 3% is recommended, this means that the amount of fat is optimal for the elaboration of Manjar de leche in special help us in the product texture (Herrera, 2012).

In acidity of the milk, the reading was of 16°D and according to the norm (Edict of Government, 1984a-c) a range of between 13 and 17°D must be handled, so that, the acidity requirements are met which makes this milk a measure of the concentration of proteins and phosphates in milk of good quality (Sbodio and Revelli, 2012).

As regards the reductase, this was 3.28 h, according to the norm (Edict of Government, 1990) it must have a reading of 3-5 h which indicates that the microbial amount of protein is within the established range, this must be to

the distinction between the reductase generated by the microorganisms present and whose activity increases as they increase (Revilla, 2009).

In total solids, there was a reading of 28.83% which is regulated in the standard (Edict of Government, 1998a, b), norm that
requires a minimum of 11.2, since, this increase is significant of excellent conditions to the process by contain more fat (Zaragoza and Acribia, 2011).

Finally, the alcohol test data was taken and it gave us a negative result that according to the norm (Edict of Government, 2011a, b) is the optimum.

Physical-chemical results of flours

Humidity: In humidity of the lupine flour was 8.81% and according to the INIAP, indicates that the maximum value should be 9%, however, at lower the percentage of moisture the flour is optimal to develop the "Manjar de leche" because nutrients are retained in a better way.

In the humidity of the corn flour, a value of 13.14% was obtained, according to the norm (Edict of Government, 1981a, b), it indicates that the maximum range must be of 13.5%.

For the humidity of quinoa, a figure of 9.27% was obtained and according to technology of cereals kent, it indicates that the maximum range is 12.6%.

Ashes: In cornashes a valueof 1.15% wasobtained and accordingtothe standard (Edict of Government, 1973a, b), it indicates that the range is 1.0%, this increase is excellent and it can be deduced that the calcination process was carried out at an adequate temperature which prevented the inorganic compounds from under going alteration (fusion, de composition, volatilization or change of structure).

In the analyzes of ash in the lupine meal, a value of 1.25% was obtained and according to the INIAP, itindicates that the range is 2.38%. The ash value of the quinoa flourwas 2.01% and according to technology of cerealskent, it indicates that the range is 3.3%.

In the two cases (analisis of ashs in lupine and quinoa) denotes that the rewered efects in the speed of incineration it self that caused the volatilization of the elements K, Na, S, Cl, P, mainly, due to the circumstances, we observe that there is a decrease in the value of ashes (Codony, 2010).

Analysis in the finished product (Manjar de leche)

Acidity: From Table 2 comparison of averages according to, Tukey for the treatments in the acidity of the manjar, it can be seen that there is significant statistical difference in 4 groups, being the A_1B_1 treatment (Panela with lupine flour) the highest with an acidity higher than 0.37; The maximum acidity is 0.30 according to, the FAO standard in a pure manjar. However, the manjar improved nutritionally was based on panela and flours that provide their characteristic levels of acidity.

Table 2: Comparison of means according to Tukey for the acidity of the Manjar de leche

Treatments	Mean	Homogeneous groups
T1	0.38	A
T8	0.37	AB
T2	0.37	BC
T5	0.36	BC
T4	0.36	BC
T9	0.36	BC
T6	0.36	BC
T3	0.36	BC
T7	0.34	C

Table 3: Comparison of means according to Tukey for the pH of the Manjar de leche

Treatments	Means	Homogeneous groups
T1	6.83	A
T8	6.83	A
T2	6.80	AB
T5	6.80	AB
T4	6.77	AB
T9	6.73	ABC
T6	6.70	BC
T3	6.66	CD
T7	6.57	D

Table 4: Comparison of means according to Tukey for the density of the Manjar de leche

Treatments	Means	Homogeneous groups
T1	1.035	A
T8	1.035	A
T2	1.035	A
T5	1.035	A
T4	1.035	A
T9	1.035	A
T6	1.031	B
T3	1.030	BC
T7	1.030	BC

pH: In Table 3 comparison of means according to Tukey to 5% for the treatments in the pH of the Manjar de leche, there are six groups, the treatments T1 and T8 have higher pH than 6.80, compared to the UNE ISO 9001 standard; The optimum minimum pH value is 6.70 for a pure manjar. This result is analogous to the one of acidity being understandable that the pH of the sweetener affected the manjar.

Density: Comparison of averages according to Tukey, Table 4 shows the existence of three statistically different groups having a proximity in the treatments T1, T8, T2, T5, T4, T9 samethat are firstwith a higherdensity, however, it is important to note that the density registered low corresponds to treatments T3 and T7, whose values comply with the SENA standard which fits between 1.030 and 1.033 g/mL.

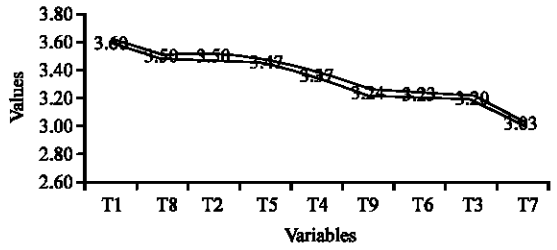

Fig. 1: Tukey's profile for the color of the Manjar de leche

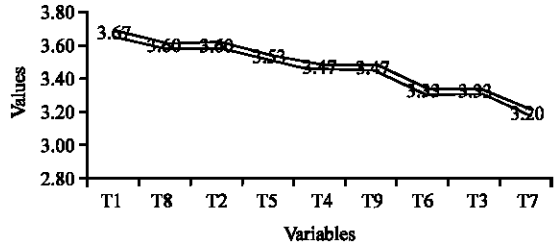

Fig. 2: Tukey's profile for the odor of the Manjar de leche

Brix: The °Brix is not a factor of variation for the present study but a standard to be met, so that, each of the treatments reached 65° Brix to meet the optimal parameter specified by FAO, (65°Brix).

Sensory tests on the finished product: In the sensory analysis 10 tasters served as evaluators of the attributes: color, odor, flavor and acceptability. The statistical results for the product manjar de leche with sweeteners and flours is detailed below:

Color is the quality of the sensation provoked in the retina of the observer that results from the interaction of light in the retina and a physical component that depends on certain characteristics of light (Sancho *et al*., 2002).

In the analysis of the color of the milk delicacy, it is observed that statistically the tasters qualify as the best treatment at T1 (Panela 900+Lupine 150 g) whose score corresponding to very good according to the Wittig scale, (Fig. 1).

The odor is the perception through the nose of volatile substances released in food, this property in most odorous substances is different for each one (Sancho *et al*., 2002).

In the analysis of the odor of the Manjar de leche, it is appreciated that numerically the tasters qualify as better treatment T1 (Panela 900+Lupine 150 g) with a score that corresponds to very good according to the witting scale, (Fig. 2).

Flavor (taste) is the complex combination of olfactory, gustatory and perceived sensations during tasting. The taste may be influenced by tactile, thermal, odorous effects (Sancho *et al*., 2002).

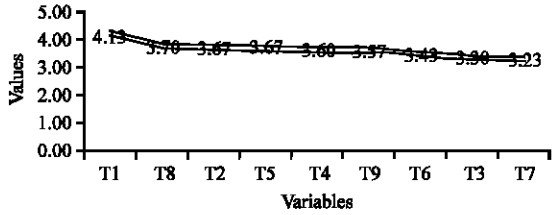

Fig. 3: Tukey's profile for the flavor of the Manjar de leche

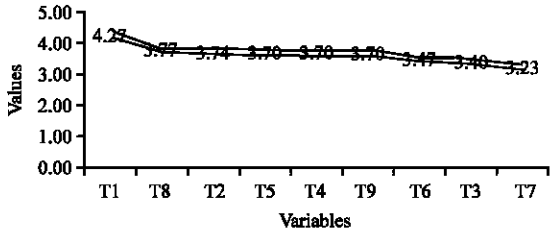

Fig. 4: Tukey's profile for the acceptability of the Manjar de leche

In the flavor of the Manjar de leche improved nutritionally, it is shown that there is a significant difference, the tasters consider as better treatment T1 (Panela 900+Lupine 150 g) with a rating corresponding to excellent according to, the scale of Witting as note in the Fig. 3.

Acceptability is the process by which man accepts or rejects a food has a multidimensional character with a dynamic and variable structure. Considering that human perception is the joint result of the sensation that man experiences and how he interprets it (Sancho *et al*., 2002).

In the test of acceptability of the Manjar de leche nutritionally improved, it is appreciated that there is a significant difference between the treatments in two groups, the tasters qualify as better treatment T1 (Panela 900+Lupine 150 g) with a score that corresponds to excellent according to, the scale de Witting, (Fig. 4).

Bromatological analysis in the best treatment: Regarding the protein, we obtained 6.73% according to Fil 20B standard, there is no stable minimum range while the maximum range for a pure Manjar de lechethat has been registered of 5.0% which denotes an increase in protein in 1.73% by the addition of lupine flour which according to INIAP is 51.07%, constitutes proteins which enriched the manjar (Revilla, 2009).

In dry matter, 68.39% was obtained, confess Zaragoza and Acribia (2011) mentions that it should be 65.5%, this shows that the results are within the required ranges in addition that the addition of lupine as a stabilizer, panela and pectin, water retention decreases, so, there is a greater amount of dry matter which is directly related to the time of concentration.

CONCLUSION

In ashes 2.40% according to, NTE INEN 014 standard the normal ash is of 2.50%, demonstrating also an increase of ashes, therefore, of minerals due to the addition of natural sweeteners.

Finally, a loss of humidity of 31.61% due to the evaporation, addition of flour and sweetener that retain in their molecules a greater amount of water, nor INEN 164, mentions that it must be 30% in order to be considered a product of good performance.

Microbiological analysis in the best treatment: The results of the microbiological analyzes performed on the best treatment showed total absence of any bacterial and microbial pathogen in 24. 48 and 72 h, complying with the norms (NTE INEN 1529-8, 1529-10 and 1529-17). This is because there was a total asepsis before and after the process.

ACKNOWLEDGEMENT

Thanks to the State University of Bolivar; Faculty of Agricultural Sciences, Natural Resources and Environment, Research Department. Biotechnological Develop and Research Centre and to the debt exchange program Ecuador-Spain for the support received in carrying out the present research.

REFERENCES

Anonymous, 2011. Processed dairy products. Food and Agriculture Organization, Rome, Italy. (In Spanish)

Brito, M., 2008. [Milk Indispensable Food]. VP Centro de Nutricao Funcional Graduate, Sao Paulo, Brazil, (In Spanish).

Codony, R., 2010. [Chemistry and Biochemistry of Foods II]. Edicions de la Universitat de Barcelona, Barcelona, Spain, (In Spanish).

Edict of Government, 1973a. [Milk Reductases Test]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1973b. [Milk, Determination of Fat Content]. Instituto Ecuatoriano de Normalizacion (INEN), Spanish, (In Spanish).

Edict of Government, 1981a. [Flours of Vegetable Origin, Determination of the Loss by Heating]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1981b. [Flours of Vegetable Origin; Determination of the Ash]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1984a. Milk; Determination of Total Solids and Ashes. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1984b. [Milk; Determination of Relative Density]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1984c. [Milk; Determination of Titratable Acidity]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1990. [Microbiological Control of Food; Determination of Fecal Coliforms and *E. coli*]. Instituto Ecuatoriano de Normalizacion (INEN), Span, (In Spanish).

Edict of Government, 1998a. [Microbiological Control of Food Mesophiles Anaerobial Bacteria; Tube Counting by Planting in Mass]. 1st Edn., Servicio Ecuatoriano De Normalizacion Inen, Quito, Ecuador, (In Spanish).

Edict of Government, 1998b. [Microbiological Control of Food, Mouses and Viable Yeasts, Couplings on Plate for Planting in Depth]. 1st Edn., Servicio Ecuatoriano De Normalizacion Inen, Quito, Ecuador, (In Spanish).

Edict of Government, 2011a. [Manjar or Dulce de Leche, Requirements]. 1st Edn., Servicio Ecuatoriano De Normalizacion Inen, Quito, Ecuador, (In Spanish).

Edict of Government, 2011b. [Milk, Qualitative Test Methods for Quality Determination]. 1st Edn., Servicio Ecuatoriano De Normalizacion Inen, Quito, Ecuador, (In Spanish).

Herrera, C., 2012. [Chemistry of Food]. University of Costa Rica, Costa Rica, (In Spanish).

INEN., 2009. [Elaboration and requirements demanded in condensed milk]. INEN, Servicio Ecuatoriano de Normalización, Quito, Ecuador. (In Spanish)

INEN., 2011. [Elaboration and requirements demanded in the milk delicacy]. INEN, Servicio Ecuatoriano de Normalización, Quito, Ecuador. (In Spanish)

Multon, J., 2008. [Additives and Manufacturing Aids in Agro-Food Industry]. 1st Edn., Editorial Acribia S.A., Zaragoza, Spain, (In Spanish).

Revilla, A., 2009. [Milk technology (In Spanish)]. Rev. Investigaciones Agropecuarias, 38: 236-246.

Sancho, J., E. Bota and J.J. De Castro, 2002. [Introduction to Sensory Analysis of Food]. Alfaomega Grupo Editor, Mexico, (In Spanish).

Sbodio, O.A. and G.R. Revelli, 2012. [Milk coagulation: Development of a device for online monitoring of the process; Advances in Argentina (In Spanish)]. RIA. Rev. Res. Farming, 38: 236-246.

Zaragoza, A. and S.A. Acribia, 2011. [Science of Milk]. 12th Edn., Impresion Mexico, Mexico City, Mexico, (In Spanish).