



RESEARCH ARTICLE

ELABORATION OF BREADS WITH FLOUR COMING FROM THE CCN 51 AND THE NACIONAL ARRIBA COCOA BEANS SHELLS

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ABSTRACT

In Ecuador, wheat production is not enough for national consumption or for the demand of the bakery, so this situation requires looking for other sources of vegetable flour to be used in the bakery industry. On the other hand, the cocoa industry produces a high quantity of cocoa shells considered as agro-industrial waste from the Nacional Arriba and CCN 51 cocoa. These shells were processed to obtain flour that could be used in the baking process, evaluating the sensory quality of the breads made with a dosage of 10% and 20% of each flour. The sensory evaluation was performed by untrained judges, using a hedonic scale from 1 to 5, with criteria ranging from "I like it a lot" to "I dislike a lot" to evaluate color, smell, taste and texture. The results confirm the sensory acceptance of the breads, which is considered the use of flour, from the shells of the two varieties of cocoa, both the Nacional Cacao Arriba and cocoa CCN 51, as an alternative source of vegetable flour to be used in the baking processes.

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INTRODUCTION

In Ecuador, the baking industry is constantly growing, according to the Ministry of Industries and Productivity data (2013). Both the Ministry together with the National Development Bank (BNF) granted new credits within the Renova Bakery Program, that so far has delivered more than USD 5.5 million to 829 bread-makers. However, in Ecuador it does not reach the national production of wheat and the demand for consumption continues to increase. According to the data of the Ministry of Agriculture, Livestock, Aquaculture and Fisheries (MAGAP), They point out that during 2014 wheat imports reached 798 thousand tons, which represented an increase of 18% compared to the purchases of 2013. Therefore, the use of flour from other vegetable origins, used in dosage form in the bakery processes, will help solve the problem and decrease the amount of wheat imported by the country. Such is the case of the flour from the cocoa shells of the Nacional Arriba and CCN 51 varieties. The cocoa industry produces a high quantity of husks of these varieties of cocoa, which are considered as agro-industrial waste, representing approximately 12% of the weight of roasted cocoa beans

according to the data of Cuesta (2008), and it is estimated that there were approximately 2770.8 metric tons of cocoa husks in the 2015 period. Additionally, flour from cocoa husks is cheaper because it comes from agro-industrial waste, what is considered low cost raw material, decreasing in breadmaking both the consumption of wheat flour and the cost of the breads. Therefore, in this investigation the elaboration of breads was made using different percentages of the flours coming from the shells of the Nacional Arriba and the CCN 51cocoa beans, offering an innovative alternative to use flour from agroindustrial waste in baking.

MATERIALS AND METHODS

The sampling for the present investigation was made in the province of Guayas, Ecuador. For this, five samples weighing 600 g of roasted cocoa husks were taken from five different batches in two cocoa industries. One industry provided the samples from the Nacional Arriba coca and the other industry facilitated the samples from the CCN 51 coca. In this way, a total of 10 samples were counted for the two varieties of cocoa. To obtain the flour, the samples of both varieties were ground separately in an Oster mill to be homogenized and stored in low density polyethylene bags.

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The elaboration of the breads was made with the proportion based on the dosage of the flour of the cocoa shells with respect to the wheat flour, with two different percentages, with formulations of 10% and 20%. Said percentages were selected based on other works where better sensory results were reported with dosage percentages of 10% and 20% for flour from other vegetable origins and the rest of wheat flour, with three repetitions for each product, according to the table 1:

**Table 1. Formulation for making bread**

Formulas	% of cocoa shells flour	% wheat flour	Repetitions
Bread with flour from the National Arriba cocoa shells.			
P1	20	80	3
P2	10	90	3
Bread with flour from the CCN51 cocoa shells.			
P3	20	80	3
P4	10	90	3

**Source:** The authors, 2017. The formulations: P1, P2, P3 and P4 refer to the different formulas for changing the percentage of cocoa husk flour in the preparation of breads.

For the elaboration of bread with the flour of the cocoa shells, a series of stages were carried out that included, as an initial stage, the weighing of the ingredients with a 60% hydration rate for both types of flours with their different dosage percentages. The second stage was the mixing of the ingredients, continuing with the kneading until obtaining a firm and homogeneous mass. The fourth stage was the rest of the dough for approximately 30 minutes followed by boleado, where the dough was divided and 50 g pieces were formed. During the sixth stage, the Fermentation, the bread pieces were left to double their size (approximately 1 hour) to finish with the baking by entering the breads into the industrial gas oven at a temperature of 180 ° C for 20 minutes. The breads were cooled to room temperature and packed in polyethylene bags. The sensory characteristics of the breads were analyzed to select the best treatment, using a panel of 30 untrained people (they are not judges trained for the organoleptic analyzes), and a sensory evaluation of a hedonic scale was applied, with a numerical scale of 1 to 5, where 5 corresponds to "I like it a lot" and 1 corresponds to "I dislike it a lot". For the sensory evaluation, each judge was given 4 bread samples of approximately 60 g. The samples were coded to guarantee the reliability of the processes and their results, while the judges evaluated the color, taste, smell, texture of each sample, recording their evaluations in the given format.

## RESULTS

The results of the sensory analysis of the breads made with the flour dosage of the National Arriba cocoa shells, with a percentage of 20% (code P1), are shown in Table 2. It is noted that there was no evaluation by the judges on the "I dislike a lot" scale for any of the sensory attributes. One vote for "I dislike moderately", 14 evaluations for "I am indifferent". On the other hand, more than 53% of the evaluations were for the highest category in the questionnaire and more than 34% for the "I like moderately" scale, the rest of the evaluations were assigned for the other scales.

In the case of breads made with the same flour dosage with a percentage of 10% (code P2) the results are detailed in table 3, observing 17 evaluations by the judges in the scales of "I dislike moderately" and another in the scale of "I dislike a lot". However, there were 38 votes on the "I'm indifferent" scale.

In total, more than 23% of the evaluations of the four attributes were for the highest scale (I like it a lot), 30% for the category "I like it moderately" and the rest of the evaluations were assigned for the other scales. On the other hand, the results of the sensory analysis of the breads made with the dosage of 20% of cocoa husk flour CCN 51, coded with the code (P3), is detailed in table 4.

There was an evaluation by the judges on the scale of "I dislike moderately", one on the scale of "I dislike a lot" and 21 votes on the scale "I am indifferent". In total, more than 46% of the evaluations of the four attributes were for the highest scale (I like it a lot), 41% for the "I like moderately" scale and the rest of the evaluations were for the other scales. The breads made with the same flour dosage with a percentage of 10%, were coded with the code (P4), as it is detailed in the table 5. It can be observed that there were 10 evaluations by the judges in the "moderately displeasing" scales, 4 for the "I dislike a lot" scale. In addition, there were 38 evaluations on the scale "I am indifferent", 5 for Taste, 4 for Color and 3 for Texture. In total, less than 22% of the evaluations of the four attributes were for the highest scale (I really like it), 34% for the "I like moderately" scale and the rest of the evaluations for the other scales. Applying the numerical scale for the four evaluations, it can be concluded that the breads made with flour from the National Top 20% cocoa husks (P1) have the best sensory acceptance with 528 points, as can be seen in table 6.

**Table 2. Results of the sensory analysis of the bread made with 20% flour from the National Arriba cocoa shells**

Atributo	I like a lot	I like moderately	I am indifferent	I dislike moderately	I dislike a lot
Color	15	12	2		
Taste	16	7	4	1	
Smell	15	12	5		
Texture	18	10	3		

Source: Own elaboration, 2017.

**Table 3. Results of the sensory analysis of the bread made with 10% flour from the National Arriba cocoa shells**

Atributo	I like a lot	I like moderately	I am indifferent	I dislike moderately	I dislike a lot
Color	9	7	10	4	
Taste	4	10	10	6	
Smell	8	9	9	4	
Texture	7	10	9	3	1

Source: Own elaboration, 2017.

**Table 4. Results of the sensory analysis of bread made with 20% flour from the CCN 51 cocoa shells**

Atributo	I like a lot	I like moderately	I am indifferent	I dislike moderately	I dislike a lot
Color	14	9	7		
Taste	15	11	4		
Smell	14	9	6		1
Texture	13	12	4	1	

Source: Own elaboration, 2017.

**Table 5. Results of the sensory analysis of bread made with 10% flour from the CCN 51 cocoa shells**

Atributo	I like a lot	I like moderately	I am indifferent	I dislike moderately	I dislike a lot
Color	7	7	11	3	1
Taste	6	13	8	4	1
Smell	7	11	10	1	1
Texture	7	10	9	2	1

Source: Own elaboration, 2017.

**Table 6. Total results of the score sum of the sensory evaluation**

Breads	P1	P2	P3	P4
Total score	528	433	509	437

Source: Own elaboration, 2017.

The breads made with the same flour with a percentage of 10% (P2) were in fourth place with a total of 433 points and the breads made with cocoa husks CCN 51 with a percentage of 20% (P3) ranked second with total of 509 points. The Student Infostat version was used to analyze the results and verify whether or not there is a significant difference between the different formulas. The analysis of variance indicates that there is a significant difference between the formulas of the breads confirming the previous data.

## DISCUSSION

The results obtained from the sensory evaluation of breads made with different formulas of the present investigation were compared with the results obtained in the research carried out by Cerón, Hurtado, Osorio and Buchely (2011) for the partial replacement of wheat flour with potato flour (*solanum tuberosum*) for the production of bread. It was observed that breads made with partial replacement of wheat flour with potato flour, with a percentage of 20%, they obtained the highest scores in sensory analysis, which is in accordance with the results of the present investigation. Contrary to what was reported in the research carried out on the preparation of bread with mashua flour (*Tropaeolum tuberosum*) by Guerra y Veranza (2014), where it was confirmed that the formula with the lowest evaluation was 20% mashua flour. On the other hand, in the work carried out by Ordoñez and Oviedo (2010), for the elaboration of bread based on wheat flour, plantain and rye, it was concluded that the best formula in relation to the organoleptic characteristics was with the dosage of 25 % plantain flour and 5% rye flour. Similar results can be observed in the research conducted by Díaz and Sevilla (2011) on the mixture of rice flour and wheat flour for baking, where they reported that the breads with the best sensory characteristics were those made with 30% rice flour. In both investigations higher percentages were obtained than what was reported in the present investigation to substitute wheat flour. Likewise, in the research conducted by Arozarena and Marin (2014), for the production of bread using flour composed of wheat, cassava and soybeans, it was confirmed that breads made with partial substitution of wheat flour for 5% soybean flour and 10% cassava flour is the best treatment.

On the contrary, with the results obtained from the work carried out by Cobo, Quiroz and Santacruz (2013), where they confirmed that the percentage to replace wheat flour with white carrot flour (*Arracacia xanthorrhiza B.*) for the preparation of bread and obtain the best sensory and physical characteristic, was with a dosage of 10%. This percentage is in agreement with that reported in the research of bread making with wheat flour and kiwicha flour (*Amaranthus caudatus L.*) made by Chagman and Humán (2010), where they confirmed that the best formula was the one elaborated with 10% of kiwicha flour and 90% of wheat flour. In this way, it can be observed that the sensory evaluation varies depending on the origin of the vegetable flour to be dosed in the baking processes, which is responsible for significant changes in the organoleptic characteristics of the breads

## Conclusion

It was possible to make bread using the flour coming from the shells of both varieties of cocoa, with different percentages of dosage of these. The formula that obtained a higher score in the sensory analysis was the bread made with 20% of flour from the National Arriba coca shells, followed with the formula of the breads made with 20% of the flour from the CCN 51 coca shells, thus confirming the sensory acceptance of such flours in baking.

## REFERENCES

- Arozarena, I. y Marin, R. Junio de 2014. *Universidad Pública de Navarra. Tesis de Máster*. Obtenido de Desarrollo de un producto de panificación mediante harina compuesta de Trigo, Mandioca y Soja.: [http://academica-e.unavarra.es/bitstream/handle/2454/13723/Marcos\\_Ballat%20TyC%20-IAA.pdf?sequence=1](http://academica-e.unavarra.es/bitstream/handle/2454/13723/Marcos_Ballat%20TyC%20-IAA.pdf?sequence=1)
- Cerón, A., Hurtado, A., Osorio, O. y Buchely, M. (2011). Estudio de la Formulación de la Harina de Papa de la variedad Parda Pastusa (*Solanum Tuberosum*) como sustituto parcial de la harina de trigo en Panadería. *Biocología en el Sector Agropecuario y Agroindustrial. Vol. 9*, 105-111.
- Chagman, G y Humán, J. 2010. Sustitución parcial de harina de Trigo (*Triticum aestivum L.*) por Harina de Kiwicha (*Amaranthus Caudatus L.*) usando el método directo y esponja y masa, en la elaboración de Pan. *Soc Quím Perú*, 377-388.
- Cobo, G., Quiroz, M. y Santacruz, S. 2013. Sustitución parcial de trigo (*Triticum aestivum*) por zanahoria blanca

- (*Arracacia xanthorrhiza* B.) en la elaboración de pan. *Avances- ISSN. 13905348*, 41-44.
- Cuesta, J. 2008. *Diseño de una línea procesador de pasta de cacao artesanal*. Obtenido de dspace.espol: <https://www.dspace.espol.edu.ec/bitstream/123456789/11394/3/Tesis%20completa.pdf> (5 de Junio del 2015)
- Díaz, M y Sevilla, A. 10 de Junio de 2011. *Estudio experimental para la formulación de las mezclas de harinas de Arroz y Trigo en la industria de la panificación*. Obtenido de Tesis de Grado. Universidad de Guayaquil: [www. repositorio.ug.edu.ec/bitstream/redug/2079/1/1066.pdf](http://www.repositorio.ug.edu.ec/bitstream/redug/2079/1/1066.pdf)
- Guerra, A y Veranza, G. Marzo de 2014. *UTE. Tesis de Grado*. Obtenido de Estudio de la utilización de la harina de Mashua (*Tropaeolum Tuberosum*) en la obtención del Pan de Molde: [http://repositorio.ute.edu.ec/ bitstream/123456789/ 5061/1/55524\\_1.pdf](http://repositorio.ute.edu.ec/bitstream/123456789/5061/1/55524_1.pdf)
- Ministerio de Agricultura, Ganadería, Acuacultura y Pesca. 2014. *MAGAP*. Recuperado el 12 de Junio de 2016, de <http://www.agricultura.gob.ec/importaciones-de-trigo-no-pagan-aranceles/>
- Ministerio de Industrias. ISSN 1390-7522, Febrero-Marzo 2013. Créditos para panificadores. *País productivo*, 17.
- Ordoñez, G y Oviedo, R. 2010. *ESPOL.Tesis de Grado*. Obtenido de Alternativas de aprovechamiento de harinas no tradicionales para la elaboración de Pan Artesanal: <https://www.dspace.espol.edu.ec/bitstream/123456789/14428/4/Elaboraci%C3%B3n%20de%20Pan%20Artesanal.pdf>

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