

5.3 PHYSICAL AND SENSORY CHARACTERISTICS OF BEAN BROTH

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Previous studies on bean preparation and utilization has shown that bean broth consumption is very popular in Guatemala. It was also found that bean broth, is used as a weaning food, which is given to the children at six months of age. A thick cooking broth is preferred because the mother relates it with a higher nutritional value; a deep black coloured bean broth is also preferred.

The purpose of this work was to develop a methodology to assess bean broth quality at the laboratory level by using chemical, physical, and sensory procedures. Six varieties of black beans were used (Chichicaste, Criollo A, Criollo B, Itzapa, Sesenteño and Tamazulapa). Each variety was cooked at different cooking times previously selected by a group of panelists, based on texture of the grains; the cooking broth obtained was evaluated by the following parameters: general acceptability by 30 "in house" panelists, using a hedonic scale from 1 to 9. Viscosity was determined by using the total solids content according to the AOAC method, and by the use of a Viscosimeter (Brookfield) and color was assessed by the Lovibond Tintometer.

Preliminary results on the cooking bean broth acceptability as related to the cooking time for the six bean varieties is shown in Table I. As it can be observed bean broth acceptability increases with cooking time which is clearly related to the total solids content in the samples that

were evaluated. However, according to the sensory method used a minimum score of 7 in the hedonic scale would be necessary to have a good acceptability criteria from the consumer point of view. The data obtained indicate that not any of the bean broths studied attained an average score of 7, which could be due to its relative low amounts of total solids content. Previous information on consumer survey has indicated that optimum amounts of total solids content should be around 13 g %.

On the other hand, data reported by L. Chan on cooking time of these same bean cultivars assessed by panelists as percentage of cooked beans (based on texture) showed that acceptability increases with the cooking times, and that final cooking time were different among the cultivars studied, varying from 200 to 240 minutes; indicating that optimum cooking time (based on texture) are not necessarily adequate for acceptability as far as the cooking broth is concerned. Therefore, in order to determine the optimum cooking time for the optimum cooking broth acceptability, four additional cooking times were evaluated, starting with the maximum cooking time (300 minutes) used in the previous study, and the data are shown in Table 2. In this case overall acceptability of bean broth was correlated with broth viscosity and color respectively, using a hedonic scale which are explained at the bottom of Table 2.

The results obtained indicated again that in general overall acceptability increases as cooking time increases, indicating also that overall acceptability was related to viscosity as assessed by the panelists, and in a lesser extent with broth color. It is also important to mention that

in this case, a score of 7 or higher was attained with cooking times higher than 3000 minutes. Different cooking times were needed to reach acceptable characteristics of the broth from the different bean cultivars.

From the data obtained so far the following conclusions can be made:

- There are significant correlations between overall acceptability and acceptability for viscosity ($P > 0.05$) suggesting that viscosity of the broth is an important characteristic for acceptability. This was observed in the six varieties.
- Overall acceptability showed a non significant relationship with bean broth color.
- An association between acceptability for viscosity and acceptability for color was found in 5 of the 6 varieties studied, indicating that increased viscosity is related to the bean broth color.
- In general overall acceptability increases with cooking time, although only a maximum score of 7 was obtained with the varieties studied.
- Overall acceptability is more influenced by the viscosity than by the bean broth color.

Finally, it must be emphasized that the data obtained with the studies related to cooking time and their acceptability by the consumers in terms of texture of the raw and cooked beans, flavor of the cooked beans, as well as acceptability of the cooking broth, are of outmost importance not only from the methodology but also from the practical point of view. The ultimate contribution of these findings will be evaluated in the future by its application for screening purposes by the plant breeders as well as for developing processes by food technologists and recipes by the home economists.

BEAN BROTH ACCEPTABILITY AS RELATED TO ITS TOTAL
SOLIDS CONTENT

Variety/Cooking time (Minutes)		Overall Acceptability*	Average** total solids content
Chichicaste	60'	5.1	1.92 + 1.6***
	95'	4.9	3.57 + 1.3
	155'	5.5	4.64 + 1.5
	240'	6.1	6.48 + 1.6
	300'	6.6	7.41 + 1.4
Criollo A	100'	4.8	2.51 + 1.24
	140'	5.5	3.81 + 1.9
	170'	6.1	4.18 + 2.0
	240'	5.9	6.33 + 1.4
	300'	6.0	6.66 + 1.5
Criollo B	90'	4.4	3.41 + 1.5
	155'	5.3	4.14 + 1.8
	205'	5.4	4.83 + 2.0
	240'	5.3	6.21 + 2.0
	300'	6.1	6.42 + 2.0
Itzapa	95'	4.6	2.86 + 2.0
	120'	4.6	3.67 + 1.8
	180'	6.5	4.67 + 1.6
	225'	6.0	7.59 + 1.7
	300'	6.4	6.82 + 1.7
Sesenteño	90'	4.3	2.76 + 1.5
	110'	5.2	3.95 + 1.5
	170'	6.0	6.45 + 1.5
	240'	6.5	8.55 + 1.4
	300'	6.4	9.20 + 1.5
Tamazulapa	90'	5.2	3.57 + 1.6
	110'	5.5	3.94 + 1.4
	150'	6.3	4.54 + 1.3
	200'	5.9	6.84 + 1.7
	350'	6.0	7.42 + 1.5

* Average of 30 panelists: 1= dislike extremely; 9= like extremely.

** A.O.A.C. Method was used to assess total solids content.

*** Standard deviation.

TABLE 2
RELATIONSHIP BETWEEN BEAN BROTH COLOR AND VISCOSITY AND ITS
ACCEPTABILITY 1/ BY THE CONSUMER USING SENSORY
METHODS

Variety/Cooking Time (Minutes)		ACCEPTABILITY <u>2/</u>		
		Overall <u>3/</u>	Viscosity <u>4/</u>	Color <u>5/</u>
Chichicaste	300'	6.0	1.46	2.46
	340'	7.13	1.93	2.65
	380'	6.56	1.93	2.33
	420'	7.33	2.22	2.60
Criollo A	300'	6.53	1.66	2.80
	340'	6.56	1.53	2.60
	380'	7.33	2.06	2.93
	420'	6.66	1.73	2.60
Criollo B	300'	4.64	1.06	2.35
	340'	7.33	1.78	2.71
	380'	7.43	2.57	3.14
	420'	6.64	1.71	2.85
Itzapa	300'	7.33	1.93	3.46
	340'	7.33	2.06	2.80
	380'	7.26	2.06	2.73
	420'	7.33	2.06	2.46
Sesenteño	300'	4.80	1.37	2.25
	340'	5.00	1.25	2.31
	380'	5.75	1.75	2.49
	420'	6.88	2.18	2.81
Tamazulapa	300'	5.13	1.00	2.13
	340'	5.13	1.20	2.13
	380'	6.87	1.86	2.80
	420'	7.00	1.93	2.66

1/ Average of 30 "in house" panelists.

2/ As judge by the panelists.

3/ Overall: 1= dislike extremely; 5= like extremely.

4/ Viscosity: 1= thin; 2= thick; 3= very thick.

5/ Color: 1= dark brown; 2= brown; 3= black; 4= deep black.

5.4 QUESTIONS AND DISCUSSION- THIRD SESSION

a.) BEVERLY WATTS (Effect of cooking time and storage on the texture of Guatemalan black beans.)

J.M.AGUILERA

Q:-Sensory scores were all around 5 and 6, even though 8 was very acceptable, why did that happened?

A:-They were not trained panelists and probably the fact that beans had no salt affected the score. Seed coat and particle size had also a great effect on acceptability.

J.RIVERA

What is the usefulness of a OTMS cell in determining other physical properties?

D.W.STANLEY

It has shown to be good for obtaining relative force. It is very useful for storage studies. There are different in seed coat hardness and cotyledon hardness between bean species.

A. HOHLBERG

Q:-Shouldn't the whole force-deformation curve be analyzed instead of the max. force?

A:-The OTMS is very sensitive to the set up. Keeping the tolerances and the distance from the bottom is important and failure to do so may affect the results.

J.M AGUILERA

The maximum acceptable force for black beans seem to be around 200 - 300 Newtons. This values are is similar to the values we are getting for 2 hrs. cooked beans.

b.)BRENDA RIOS (The influence of sensory attributes on the acceptability of twenty lines of guatemalan black beans.)

L. LARED

-The last regression equation has 3 factors and 5 points. This is a wonderful work but it should be considered that trained panelist, consumers, and machines are different levels of evaluation.

Q:-Can particle size be quantified?

A:-Particlerize can be quantified. I prepared two different particle sizes standards for training.

J. M. AGUILERA

Q:-To what extent the sensorial properties are raversible upon cooking?

A:-They are not reversible. Hard beans were cooked for 9 hrs., so we can definitively say that hard beans will never have the same properties (hardness, particle size, cohesion and split) as fresh beans.

L. PHLAK

Q:-What is the effect of storage?

A:- We did not determined that, but the older beans were the had the least acceptability.

D. W. STANLEY

Particle size may be related to starch but also to the tissue. Still, I think

that is related to water hydration.

c.) DR. LUIS ELIAS (Physical and sensory characteristics of bean broth)

B. RIOS

Q:-It seems that the thicker the broth the higher the acceptability.

A:-It never reached the 9 score (maximum) only acceptable (7) values. But this was an untrained panel.

L. LAREO

Q:-How did you made relationships between panel viscosity and physical viscosity?

A:-We used total solids but not the Brookfield.

W. EDWARDSON

Then the correlations on viscosity may not be meaningful.

B. WATTS

Thicken broths are more acceptable but the Brookfield is difficult to use because it has suspended material, so correlations are difficult to make.

DR. ELIAS

When stored beans are analyzed, their color fades. We should address to the question that acceptability is more than hardness. The same thing is relevant to quantify losses to the small farmer.

W. EDWARDSON

Q:-Do you think hard beans solubilize less in the broth?

A:-Hard beans have lighter color and less viscosity.

L. PHLAK

Q:-Does soaking has an effect on the broth?

A:-The cooking methodology will effect the using of the broth.

B. WATTS

Also, suspended materials increase with time during soaking.

J. RIVERA

Q:-Can the nutritional value of the broth be comparable to the one of whole beans?

A:-The broth has less nutritional value than the bean. The reasons why people in Guatemala feed their children with the broth may be:

a) Diarrhea caused by tannin aggregation;

b) Broth has a lot of Na^+ and K^+ that are good for hydration of the children.

F. LAJOLO

Q:-Does the housewife squeeze the beans to thicken the broth?

A:-She is afraid to feed solids and only after 1 year they start feeding beans.