



SHELF LIFE STUDY OF BANGUS (MILKFISH) BONE POWDER

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ABSTRACT

This study determined the shelf-life of bangus bone powder packed in glass jar and polyethylene bag stored for 50 days in ambient temperature. Specifically, it describe the quality attributes of bangus bone powder such as color, odor, texture, aftertaste and graininess, determine the fat, moisture and microbial load content, determine the relationship between microbial load and quality attributes. The bone powder was sensory analyzed by trained panelists from 0 day to 50 days, chemically analyzed at DOST- I using ether extraction method and gravimetric method while microbial load was analyzed using plate count method. Results showed that the bangus bone powder packed in glass jar and polyethene bag stored for 50 days are comparable in quality attributes which are light brown in color, fishy odor, fine in texture, strong in aftertaste, fine graininess and has a fishy taste. In terms of acceptability, the panelists rated “like slightly to like very much”. However, statistical analysis showed that bone powder packed in glass jars and polyethylene bag are comparable. Chemical analysis showed bangus bone powder packed in glass jars and polyethylene bag stored from 0 to 50 days has fat content of 22.8 g ($^{\circ}/_{100g}$) and 22.7 g ($^{\circ}/_{100g}$) respectively. In terms of moisture content, the initial moisture and final moisture content of bangus bone powder packed in glass jar is 3.4 g ($^{\circ}/_{100g}$). However, for bangus bone powder packed in polyethylene bag, the initial moisture content of 3.4 g ($^{\circ}/_{100g}$) increased to 3.5 g ($^{\circ}/_{100g}$) after 50 days of storage. In terms of microbial load, bangus bone powders packed in glass jars from 0, 30 and 50 days are 220^{cfu}/g, 280^{cfu}/g and 350^{cfu}/g. Correlation analysis revealed that microbial load significantly affected the odor of bangus bone powder packed in glass jar. However, other quality attributes such as taste, color, texture,

aftertaste, and graininess were not significantly affected by microbial load. No significant relationships between microbial load and quality attributes were found indicating that packed bangus bone powder can be stored and still acceptable after 50 days.

Keywords: acceptability, bangus bone, microbial load, shelf-life, sensory evaluation

INTRODUCTION

Region I, specifically in Pangasinan is known for milkfish locally known as “bangus” where volume of production mostly comes from Pangasinan. Bangus is delicious and nutritious but it has plenty of spines that sometimes parents are hesitant to serve this to their children. This is the reason of promoting bangus deboning technology which became a lucrative business activity in Pangasinan and in La Union. It is now a continuing activity due to the availability of raw materials. Many consumers prefer deboned bangus which is ready to cook because they have no time to prepare their food. However, bangus deboning activity produces volume of scrap which may contribute pollution in the environment. The scrap of bangus deboning is nearly 25% per piece of bangus (Guevara et al., 2000). The Anjos and Sandoval Farms, the two big producers of deboned bangus in Pangasinan are producing volumes of scraps for deboning 2000 pieces of bangus per day. Their scraps are used as foddors while a great bulk is thrown away. According to Hui (1998) there is no such thing as scrap in fish, because it is rich in nutrients. It can be made into food items for human consumption.

The bangus bone powder is a potential raw material in developing food items. Research institutions have conducted several studies on food product development by adding bangus bone powder as an ingredient. Findings of the study showed that the cookies and polvoron formulated was “liked very much” by the respondents (Afalla et al., 2003 and Calmorin, 2000). It is a plan of the researchers from different institutions to commercialize the food items they have developed but they have encountered problems on bangus bone powder to sustain the production.

The preparation of bangus bone powder involves several processes such as washing, boiling, pressure cooking, oven drying and grinding (Afalla et al., 2003). This activity will affect the volume of production of food products like cookies for commercialization. This should therefore be prepared in one setting especially during the peak season of deboning bangus. Eventually, a ready source of raw material for bone powder preparation would be available. The

packaging material of bone powder is also an important consideration in the production and during storage of bangus bone powder to protect the product against mechanical and climatic hazards, losses, spillages, pilferages, degradation and contamination.

The commercialization and further development of food products from bangus bones is sustained on the availability of ready-to-use raw material, which is the bone. The preparation of bone powder therefore should be undertaken, packed and stored for future consumption. Furthermore, no study has been conducted on the shelf life of bangus bone powder, hence, this study.

OBJECTIVES OF THE STUDY

General: To determine the shelf-life of bangus bone powder using glass jar and polyethylene bag.

Specific:

1. To determine the quality attributes of bangus bone powder;
2. To determine the fat, moisture and microbial load of the bangus bone powder;
3. To determine which of the two packaging material is better in storing the bangus bone powder; and
4. To determine the relationship of quality attributes and microbial load of bangus bone powder.

METHODOLOGY

Preparation of bangus bone powder

Bangus bones were procured at Anjo Farm in San Fabian, Pangasinan. Bangus bones were packed in styrofoam box with ice and transported to DMMMSU-IF. Packaging materials such as glass jars (Gerber bottle) and polyethelene bags (0.004, 4 in in width and 10 in in length) were purchased in Agoo, La Union. Upon arrival at DMMMSU-IF Fish Processing Laboratory, bangus bones were washed thoroughly and the blood adhered to the bones was removed. After washing and cleaning, bangus bones were soaked in a kettle using baking soda for two hours, followed by boiling for 30 minutes. One (1) cup of calamansi juice was added every boiling time in a 10 kg of bangus bones in order to remove the fat content of the bones. Calamansi juice also

served as deodorizer by removing the fishy odor of bangus bones. Boiled bangus bones were drained using an aluminum strainer and pressure cooked for 90 minutes at 10 psi.

Storage

Packed bangus bone powder was stored for fifty (50) days at room temperature.

Treatments

Two treatments were used in the study and two trials were also conducted for each treatment.

Treatment	Packaging Material
I	Glass Jar
II	Polyethylene bag

Data Gathering

Sensory evaluation was conducted on the quality attributes of bangus bone powder packed in glass. Jars and polyethylene bags were evaluated as to color, odor, texture, taste, graininess and aftertaste. Sensory evaluation was conducted at different storage time at 0,15,30,40 and 50 days after packing. Sensory evaluation was done by trained panelists from DMMMSU-IF using a Modified Hedonic Rating Scale. Fat and moisture contents of bangus bone powder were chemically and microbiologically analyzed using ether extraction while moisture content was determined using the gravimetric method. Plate count method was used in the analysis of microbial load of bangus bone powder packed in glass jars and polyethylene bags at different storage period.

Data Analysis

Data gathered on the scores of respondents were analyzed using the weighted mean. Significant differences between means of the quality attributes using two packaging materials were determined using t-test. Correlation analysis was used to determine significant relationship between microbial load and sensory qualities of bangus bone powder.

RESULTS AND DISCUSSION

Bangus bone powder was subjected to sensory evaluation to describe its characteristics and determine its acceptability. It was initially analyzed immediately after processing then

packed in two (2) packaging materials and stored for several days (0, 15, 30,40,50 days) at ambient temperature.

Description of the Characteristics/Quality Attributes of Bangus Bone Powder

Table 1. Mean perception of respondents on color characteristics of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	75.70	Light brown	75.70	Light brown
15	75.70	Light brown	77.90	Light brown
30	75.00	Light brown	73.60	Light brown
40	75.70	Light brown	80.00	Light brown
50	83.60	Light brown	75.70	Light brown
Mean	77.14	Light brown	76.58	Light brown

The respondents' perception of color presented in table 1 showed that from 0 day to 50 days of storage, the mean ratings of 75.0 to 83.6 belong to the bracket of 76-100 and quality description of light brown. This observation is also noted in the bangus bone powder packed in polyethylene bag from 0 day to 50 days of storage with a mean ratings of 75.7, 77.9, 73.6, 80 and 75.7 respectively (Table 1). No significant ($P>.05$) difference was found between means which indicate that the color of bangus bone powder packed in glass jar and polyethylene bag are comparable with storage of 50 days.

Table 2. Mean perception of respondents on odor characteristics of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	82.5	Fishy	82.5	Fishy
15	82.9	Fishy	91.4	Fishy
30	86.4	Fishy	87.9	Fishy
40	84.3	Fishy	94.3	Fishy
50	88.6	Fishy	98.6	Fishy
Mean	84.93	Fishy	90.93	Fishy

The perception of respondents in terms of the odor of bangus bone powder packed in glass jar from 0 day to 50 days of storage did not vary, belong to the bracket of 76-100 which corresponds to quality description of fishy (Table 2). The observation is also true ofr in the odor of bangus bone powder packed in polyethylene bag with mean ratings of 82.5 to 98.6 from 0 day to 50 days of storage. Results of t-Test showed that there is no difference between means (84.93/90.93) meaning the odors of the bangus bone powder packed in the 2 packaging materials are comparable.

Table 2. Mean perception of respondents on texture characteristics of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	76.1	Fine	76.1	Fine
15	83.6	Fine	83.6	Fine
30	85.7	Fine	84.3	Fine
40	86.4	Fine	95.7	Fine
50	96.4	Fine	100.7	Very Fine
Mean	85.65	Fine	88.07	Fine

For texture, the perception of respondents showed that bangus bone powder packed in glass jar from initial evaluation to 50 days of storage varies in mean ratings but all belong to the bracket 76-100 which is described as fine. Similar observation was observed in bangus bone powder packed in polyethylene bag with mean ratings from 76.1 to 95.7 (Table 3) from 0 day to 40 days of storage and in 50 days of storage, the mean rating increased to 100.7 which is very fine. However, t-test showed no difference between means indicating that bangus bone powder stored in the two (2) packaging materials are comparable in texture.

Table 4. Mean perception of respondents on taste characteristics of bangus bone powder.

Storage Period (No.of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	86.1	Fishy	86.1	Fishy
15	93.6	Fishy	91.4	Fishy
30	88.6	Fishy	87.9	Fishy

40	89.3	Fishy	95.7	Fishy
50	98.6	Fishy	101.4	Fishy
Mean	91.22	Fishy	94.5	Fishy

The taste of bangus bone powder packed in glass jar from day 1 to day 50 of storage falls between 76-100, and a quality description of fishy. Similarly, the taste of bangus bone powder packed in polyethylene bag from 0 to 40 days (86.1 to 95.7) and in 50 days of storage, the mean rating of 101.4 corresponds to very fishy. No significant ($P>.05$) difference was found between means which indicates comparable taste.

Table 5. Mean perception of respondents on graininess characteristics of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	77.1	Fine	77.1	Fine
15	82.9	Fine	80.7	Fine
30	87.1	Fine	82.1	Fine
40	87.9	Fine	97.1	Fine
50	96.4	Fine	100.0	Fine
Mean	86.28	Fine	87.4	Fine

In graininess, the perception of respondents on bangus bone powder packed in glass jar from initial evaluation (0 day) to 50 days of evaluation (Table 5) falls between 76-100 which is fine. Similarly, the graininess of the bangus bone powder packed in polyethylene bag with mean ratings of 77.1 to 100 is also fine. No significant ($P>.05$) difference was found between means which indicates comparable graininess.

Table 6. Mean perception of respondents on aftertaste characteristics of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	84.6	Strong	84.6	Strong
15	88.6	Strong	88.7	Strong
30	90.7	Strong	90.8	Strong
40	97.1	Strong	97.1	Strong
50	97.1	Strong	97.5	Strong
Mean	89.62	Strong	91.74	Strong

The perceptions of respondents on the aftertaste of bangus bone powder packed in glass jar and polyethylene bag from 0-50 days of storage are similar based on mean ratings (Table 6). Statistical analysis showed no significant ($P>0.05$) difference between means which indicates that bangus bone powder have comparable aftertaste.

Acceptability of bangus bone characteristics

Table 7. Mean acceptability of color of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	6.2	Like slightly	6.2	Like slightly
15	7.0	Like moderately	7.2	Like moderately
30	6.9	Like moderately	6.5	Like moderately
40	7.2	Like moderately	7.2	Like moderately
50	7.6	Like moderately	7.6	Like very much
Mean	6.98	Like moderately	6.94	Like moderately

The mean acceptability of bangus bone powder packed in glass jar terms of color characteristic (Table 7) ranged from “like slightly” to “like moderately” from 0 day to 40 days of storage but “like very much” on 50 days of storage. Similarly, bangus bone powder packed in polyethylene bag which is “like slightly” by the respondents was “liked very much” on 50 days of storage. No significant ($P>.05$) difference was found between

means indicating comparable acceptability of bangus bone powder using the two packaging materials.

Table 8. Mean perception of respondents on odor acceptability of bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	5.5	Like slightly	5.5	Like slightly
15	6.0	Like slightly	6.5	Like moderately
30	6.1	Like slightly	5.6	Like moderately
40	7.2	Like moderately	6.9	Like moderately
50	7.7	Like moderately	7.5	Like moderately
Mean	6.5	Like moderately	6.4	Like moderately

The mean acceptability of odor of bangus bone powder packed in glass jar ranged from “like slightly” to “like very much” (Table 8) from 0 day to 50 days. Odor of bangus bone powder packed in polyethylene bag was “like slightly” to “like moderately”. The insignificant ($P > .05$) finding indicates that the odor of the bone powder was not affected by the packaging materials used.

Table 9. Mean perception of respondents on the acceptability of texture of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	5.7	Like slightly	5.8	Like slightly
15	6.4	Like slightly	6.5	Like slightly
30	6.4	Like slightly	6.7	Like slightly
40	7.3	Like moderately	7.1	Like moderately
50	7.5	Like very much	7.6	Like very much
Mean	6.66	Like moderately	6.74	Like moderately

The mean acceptability of the texture of bangus bone powder packed in the glass jar and polyethylene bag was “like slightly” from 0 to 30 days of storage, like moderately on 40 days of storage, and “like very much” on 50 days of storage (Table 9). Results of t-test showed no significant ($P > .05$) difference between means thus, the texture of bangus bone powder is not affected by the packaging materials used.

Table 10. Mean perception of respondents on acceptability of taste of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	4.7	Neither like nor dislike	4.7	Neither like nor dislike
15	5.8	Like slightly	5.9	Like slightly
30	6.1	Like slightly	6.1	Like slightly
40	7.2	Like moderately	6.9	Like moderately
50	7.9	Like very much	7.4	Like moderately
Mean	6.34	Like slightly	6.18	Like slightly

In taste, during the initial evaluation, the bangus bone powder packed in glass jar was “neither like nor dislike” by the panelists which is at the point of rejection. However, in the succeeding evaluation from 15 to 50 days of storage, the mean ratings of bangus bone powder increased. It was “like slightly” to “like very much” by the panelists with means of 5.8, 6.1, 7.2, 7.9 (Table 10).

The evaluation of bone powder packed in the polyethylene bag is almost the same with the acceptability of bangus bone powder packed in glass jar from 0 to 50 days of storage. For the powder packed in the polyethylene bag, taste was “neither like nor dislike” by the panelists on the initial evaluation, “like slightly” on the 15, 30 and 40 days, and “like moderately” on the 40 days of storage with the mean ratings of 6.9. However, results of t-test showed that there is no significant ($P>.05$) difference between means, which indicate that taste of bangus bone powder is not affected by the packaging material used.

Table 11. Mean perception of respondents on acceptability of graininess of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	5.7	Like slightly	5.7	Like slightly
15	6.2	Like slightly	6.3	Like slightly
30	6.3	Like slightly	6.3	Like slightly

40	6.8	Like moderately	77.0	Like moderately
50	7.04	Like moderately	7.4	Like moderately
Mean	6.41	Like slightly	6.54	Like moderately

The graininess of bangus bone powder packed in glass jar was “like slightly” by the panelists from 0 to 30 days but “like moderately” in 40 and 50 days of storage (Table 11). Acceptability of the graininess of bangus bone powder packed in polyethylene bag was also “like slightly” by the panelists from 0 to 30 days but “like moderately” from 40 and 50 days. Results of t-test showed no significant difference between the graininess of bone powder in glass jar and polyethylene bag indicating comparable effect of storage containers.

Table 12. Mean perception of respondents on the acceptability of aftertaste of bangus bone powder.

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	5.5	Like slightly	5.5	Like slightly
15	5.7	Like slightly	5.8	Like slightly
30	6.5	Like moderately	6.2	Like slightly
40	6.9	Like moderately	6.8	Like moderately
50	7.5	Like very much	7.3	Like moderately
Mean	6.42	Like slightly	6.32	Like slightly

The aftertaste of bangus bone powder packed in glass jar was “like slightly” by the panelists from 0 to 15 days of storage, “like moderately” on 30 and 40 days of storage, and “like very much” on 50 days of storage (Table 12). For bangus bone powder packed in polyethylene bag, respondents “like slightly” from 0 to 30 days, but “like moderately” from 40 and 50 days (Table 12). Results of t-test showed no significant ($P>.05$) difference between means which imply that aftertaste of bangus bone powder packed in glass jar and polyethylene bag are comparable

Table 13. General Acceptability of bangus bone powder

Storage Period (No. of days)	Packaging Materials			
	Glass Jar		Polyethylene bag	
	X	Quality Description	X	Quality Description
0	5.6	Like slightly	5.6	Like slightly
15	6.2	Like slightly	6.3	Like slightly
30	6.4	Like slightly	6.1	Like slightly
40	7.1	Like moderately	7.0	Like moderately
50	7.5	Like very much	7.5	Like very much
Mean	6.8	Like moderately	6.7	Like moderately

The mean acceptability of bangus bone powder packed in glass jar and polyethylene bag from 0 to 50 days increased from “like slightly” to “like very much” (Table 13). Results of t-test showed no significant (P.05) difference between means which imply that the bangus bone powder can be packed in either glass jar or polyethylene bag .

3.0 Moisture, Fats and Microbial Analyses

Table 14. Moisture, fats and microbial load of bangus bone powder

Analysis	Glass jar			Polyethylene bag		
	0 day	30 days	50 days	0 day	30 days	50 days
Microbial Load <i>cfu/g</i>	220	280	280	220	280	350
Moisture g (g/100g)	3.4	3.4	3.4	3.4	3.4	3.5
Fats g (g/100g)	22.8		22.8	22.7		22.7

3.1 Moisture

Bangus bone powder can be packed in glass jar or polyethylene bag from 0 day to 50 days has comparable moisture. However, the moisture content is still very low which means that bangus bone powder has a longer shelflife using the two storage containers. This could be attributed to the longer drying period during the preparation bangus bone. According to Hermes (1998), low moisture content of fish meal and fish flour has a longer shelflife. However, this should be maintained because the increase in the moisture content will promote rancidity that causes spoilage of the product.

3.2 Fat content

The fat content of bangus bone powder packed in glass jar and polyethylene bag was analyzed using ether extraction at 0 day and 50 days only as per suggestion of the chemist from DOST-I. Results showed that the fat content of the bangus bone powder packed in glass jar and polyethylene bag are almost comparable which is 22.8g (g/100g) in glass jar and 22.7 g (g/100g) in polyethylene bag.

3.3 Microbial load

The total microbial load count of bangus bone powder packed in glass jar using the conventional plate count analysis at 0 day, 30 days and 50 days are 220 cfu/g, 280 cfu/g, and 280 cfu/g respectively. The result was very low which is very far from the standard microbial count of dried products of 12,000 (Hermes, 1998). The microbial load count of bangus bone powder packed polyethylene bag also increased from 220 cfu/g in the initial evaluation, 280 cfu/g after 30 days, and 350 cfu/g after 50 days. While it is increased in the microbial load count, the product is still safe because it is still very low compared to the standard microbial load of dried products.

Conclusions and Recommendations

The quality attributes of bangus bone powder packed in glass jar and polyethylene bag are similar: light brown in color, fishy in odor, fine in texture, strong in aftertaste, fine in graininess, and fishy taste. Acceptability of bangus bone powder packed in glass jar and polyethylene bag was “like slightly” to “like very much” by the panelists. Fat content, moisture content and microbial load of bangus bone powder packed in glass jar and polyethylene bag are still acceptable. Microbial load significantly affected the odor of bangus bone powder packed in glass jar but did not affect taste, color, texture, aftertaste and graininess. No significant relationship existed between microbial load and sensory qualities of bangus bone powder packed in polyethylene bag. Overall, bangus bone powder packed in glass jar and polyethylene bag can be stored for 50 days. It is therefore recommended that longer period of storage should be conducted. Either of the two packaging materials can be used in storing bangus bone powder using ambient temperature. Other packaging materials should be tested.

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