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Original Research Article

Banana (*Musa* sp.) Pseudostem core as meat filler in scrapple preparation

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Keywords

Banana pseudostem core, banana psedostem; scrapple with banana pseudostem; meat filler; microbial analysis; sensory evaluation; shelf life.

A B S T R A C T

This study introduced the utilization of banana pseudostem core as meat filler in scrapple preparation and verified the potential of banana pseudostem by converting it into a usable raw material from just being garbage or pollutants after harvest. Sensory evaluation was conducted to evaluate the quality characteristics of the product and determine the most acceptable proportion. Shelf life evaluation, proximate analysis and cost analysis were also conducted. Results on sensorial characteristics evaluation revealed that the utilization of 75% pseudostem core in lieu of pork in the preparation of scrapple was possible. The said formulation was comparable to the control in terms of color, odor, flavor and texture and was evaluated as highly acceptable. Shelf life evaluation results revealed that scrapple with 75% banana pseudostem core when stored at 4^{o}C, packed in polypropylene plastics can last for 19 days. On the other hand, result of proximate composition analysis showed that it contains 64%moisture, 5.7%protein, 2.4%fat, 25.8%carbohydrates, 2.1%ash and 1.0%salt. Cost analysis conducted using Return on Working Capital (ROWC) as economic indicator showed that scrapple using 75% banana pseudostem core obtained a value of 299.08% while the control a value of 167.08%. Moreover, the former lowered the cost of production by 31.30%.

Introduction

Banana (*Musa sapientum*), a tropical plant which grows best under warm conditions crops in the Philippines. It is herbaceous plant which consists of an underground

corm and false trunk (pseudostem) with concentric layers of leaf sheaths (www.banana-plants.com). Several varieties are abundantly grown everywhere in the country. Each pseudostem can produce a single bunch of bananas.

In 2010, the Philippines was considered as one of world's largest banana-producing nations. According to Food and Agriculture Organization, the country together with Ecuador, the world's leading banana producer has the highest growth rate when it comes to production and exports (www.fao.org/docrep). Being one of the world's largest banana-producing nations, there is also one thing that is certain, the country has millions of tons of banana pseudostem left unutilized after the mature fruits are harvested. The stem is usually thrown away once the fruit is cut from the plant.

Though banana is a popular fruit and vegetable, the goodness of banana pseudostem is not known to many modern housewives. Like banana fruit, banana pseudostem is also rich in potassium. Potassium helps in the effective functioning of muscles including cardiac muscles, prevents high blood pressure, helps nerve impulses and maintains fluid balance within the body. The pseudostem is believed to be a diuretic, helps detoxify the body, prevents and treats kidney stones (www.healthmad.com/nutrition/amazing-health-benefits-of-banana-stem, 2010). It also contains other minerals such as calcium, iron, magnesium and phosphorus in large quantities. It is widely believed that cancerous cells are combated by the use of the stem in the food (www.articlesbas.com/alternative-medicine-articles/banana-for-your-health-702459.html,2008). Furthermore, it is a rich source of dietary fiber (www.healthmad.com/nutrition/amazing-health-benefits-of-banana-stem, 2010). Dietary fiber adds bulk to our diet. It can be helpful in controlling weight because it makes one feel full faster. Fiber aids digestion, helps prevent constipation, and is sometimes used for the treatment of diverticulosis, diabetes, and heart disease (www.health.newyorktimes.com.html, 2008).

Scrapple is typically a mush made from pork and cereal seasoned with onions, spices and herbs and shaped into loaves for slicing and frying. This meat product is best served during breakfast (books.google.com/books_scrapple). This food item falls under the precooked-cooked meat products which are distinguished from other categories of processed meat products by precooking the raw materials prior to grinding or chopping and also by utilizing the greatest variety of meat, animal by-product and non-meat ingredients. (www.fao.org/docrep)

Generally, after harvesting the mature banana fruits, it is a local practice to just leave the banana pseudostem out in the open which later becomes waste material which is evidently considered as "a material of no value". However, this study is determined to convert banana pseudostem into a usable and potential raw material in food processing from just being garbage or pollutants. Banana pseudostem core will be utilized as meat filler in the preparation of scrapple. In doing so, the cost of production will definitely be lowered; profit will be increased as well as adding value to banana as a crop.

Meat extenders are non-meat substances

with substantial protein content, whereas fillers are high in carbohydrates (www.fao.org/docrep/010/AI407E16.htm). According to Heinz and Hautzinger (2007), using meat fillers and extenders in meat products can lower the cost of meat by 10 to 30 percent. It is in this context that the study was conducted.

Materials and methods

The raw materials used in the study were ground pork, meat stock, cornmeal and spices. On the other hand the kitchen tools and equipment used were: bowls, carajay, ladle, knives, shredder, blender, chopping board, digital weighing scale, strainer, basins, loaf pans, and refrigerator.

Sensory Evaluation Test

The panel was composed of twenty (20) faculty members teaching food related courses. Twelve of them came from College of Industrial Technology, Aklan State University and the remaining eight panelists were from Home Technology Department, College of Agriculture, Forestry and Environmental Sciences, Aklan State University, Banga, Aklan. The panelists were selected based on their knowledge and experience in product development and product testing.

Prior to evaluation, a thorough orientation of the panelists was conducted. The sensory characteristics, namely, the color, odor, flavor, texture and overall acceptability with corresponding specifications were discussed with the evaluators.

A scorecard was used to gather data on the sensory characteristics of scrapple. Descriptive testing method was employed in evaluating the product to characterize and/or compare samples with respect to its specific characteristics. The numbers were not included on the score card so that the judges will think in terms of the adjectives rather than the numerical scores (Penfield and Campbell, 1990).

Data Analysis

To determine the significant difference between treatments, the data obtained was subjected to Analysis of Variance (ANOVA) at 5% level of significance. To further test the difference among treatment means, the Fischer's Least Significant Difference (FLSD) was employed.

Sample Analysis

The product with the highest rating (most acceptable) in terms of overall acceptability was subjected to shelf life determination. The microbiological analysis, physicochemical analysis (pH and salt content) and sensory evaluation (color and odor) of raw sample was done also as part of the shelf life evaluation. Samples were submitted to a private laboratory for analysis.

Cost analysis

To determine the Return on Working Capital (ROWC) and cost of production as economic indicators, the formula below were used:

$$\text{ROWC (\%)} = \frac{\text{Net Profit}}{\text{Production Cost}} \times 100$$

$$\text{\% Cost of Production} = \frac{CP_{Control} - }{CP_{Control}} \times 100$$

Table.1 Main ingredients in the preparation of scrapple

Ingredients	Quantity (g)
Cooked Ground Pork	400.0
Meat Stock	350.0
Cornmeal	250.0
Salt	15.0
Black pepper	1.56
Nutmeg	0.30
Celery	0.30
Onion	0.50

Source: Sebranek,Beermann and Axe, 1989

Table.2 Experimental composition of ingredients in the preparation of scrapple using different proportions of pseudostem core

Ingredients	Treatment			
	T_1 (g)	T_2 (g)	T_3 (g)	T_4 (g)
Cooked Ground Pork	400	200	100	-
Chopped pseudostem core		200	300	400
Meat Stock	350	350	350	350
Cornmeal	250	250	250	250
Salt	15	15	15	15
Black pepper	1.56	1.56	1.56	1.56
Nutmeg	0.30	0.30	0.30	0.30
Celery	0.30	0.30	0.30	0.30
Onions	0.50	0.50	0.50	0.50

Legend:

Treatment 1 – Control
Treatment 2 – 50%:50%
Treatment 3 – 25%:75%
Treatment 4 – 100%Banana Pseudostem Core (BPC)

Figure.1 Process flow in the preparation of scrapple at different proportions of pseudostem core

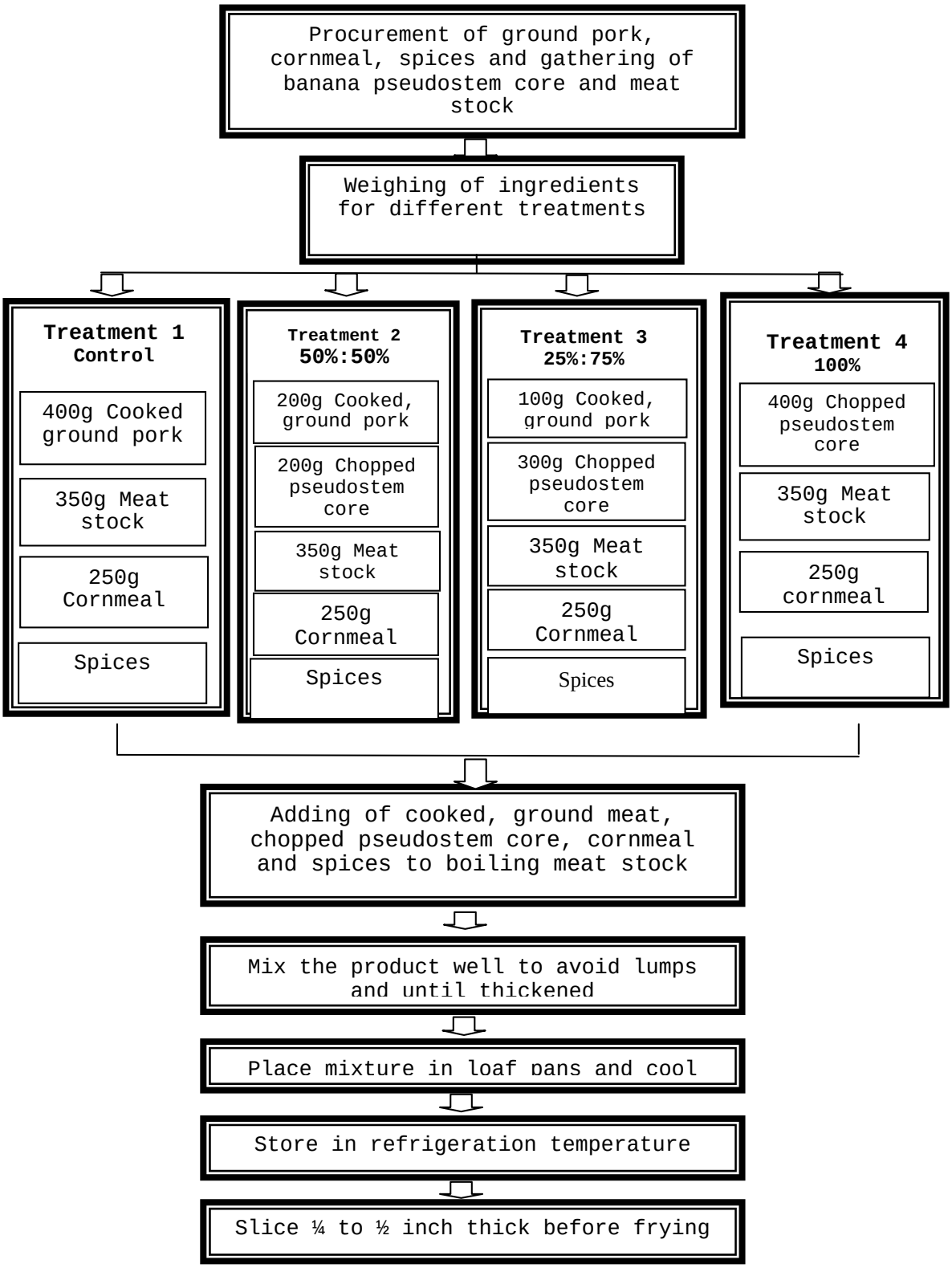

Table.3 Mean sensory score on color of scrapple using banana pseudostem core as meat filler

Treatment	Replication			Total	Mean[ns]	Descriptive Rating
	1	2	3			
Control	4.20	4.10	4.10	12.40	4.13[a]	Golden brown
50%:50%	4.45	4.30	4.25	13.00	4.33[a]	Golden brown
25%:75%	4.25	4.20	4.25	12.70	4.23[a]	Golden brown
100% BPC	3.90	4.10	3.85	11.85	3.95[a]	Golden brown
Grand Mean					**4.16**	

ns – not significant. Column means followed with the same letter superscript are not significantly different at 5% level by FLSD.

Table.4 Mean sensory score on odor of scrapple using banana pseudostem core as meat filler

Treatment	Replication			Total	Mean[ns]	Descriptive Rating
	1	2	3			
Control	4.50	4.15	4.25	12.90	4.30[a]	Moderately aromatic
50%:50%	4.00	4.00	3.95	11.95	3.98[a]	Moderately aromatic
25%:75%	4.25	4.05	4.05	12.35	4.12[a]	Moderately aromatic
100% BPC	4.15	3.80	4.15	12.10	4.03[a]	Moderately aromatic
Grand Mean					**4.11**	

ns – not significant. Column means followed with the same letter superscript are not significantly different at 5% level by FLSD.

Table.5 Mean sensory score on flavor of scrapple using banana pseudostem core as meat filler.

Treatment	Replication			Total	Mean*	Descriptive Rating
	1	2	3			
Control	4.40	4.30	4.45	13.15	4.38[a]	Recognizable meaty flavor
50%:50%	4.30	4.00	4.10	12.40	4.13[a]	Recognizable meaty flavor
25%:75%	4.20	4.25	4.25	12.70	4.23[a]	Recognizable meaty flavor
100% BPC	3.65	3.55	3.45	10.65	3.55[b]	Recognizable meaty flavor
Grand Mean					**4.07**	

*Significant. Column means followed with the same letter superscript are not significantly different at 5% level by FLSD.

Results and Discussion

Color Evaluation of Scrapple

The color evaluation of fried scrapple with varying proportion of chopped pseudostem core is presented in Table 3. All samples were perceived by the panelists as "Golden brown" as evidenced by the resulting mean sensory scores. Treatment 2 (50% Ground pork: 50% Chopped pseudostem core) obtained the highest mean score of 4.33 followed by Treatment 3 (25% Ground pork : 75% Chopped pseudostem core) with mean score of 4.23, then Treatment 1 (100% Ground pork) and Treatment 4 (100% Pseudostem core) with mean scores of 4.13 and 3.95, respectively. According to Lynn Kerrigan (1998) the golden brown color is an ideal color of tasty looking scrapple.

An analysis of variance using F-test at the 5% level of significance revealed that there was no significant difference existed among treatment means in terms of color. This result implied that the three samples (Treatments 2, 3 and 4) with chopped pseudostem core were comparable to the Control (Treatment 1) in terms of color.

Odor Evaluation of Scrapple

Table 4 presents the mean scores for odor of scrapple. The odor of all treatment samples was evaluated as "moderately aromatic" with mean score of 4.30 for the Control (Treatment 1), 3.98 for Treatment 2, 4.12 for Treatment 3 and 4.02 for Treatment 4.

An analysis of variance (ANOVA) using F-test at the 5% level of revealed that there was no significant difference existed between treatments. The result signifies that varying proportion of chopped banana pseudostem core incorporated in the preparation of scrapple did not affect the odor of the product. The result further shows that in terms of odor, all samples with chopped pseudostem core were comparable to the Control (Treatment 1).

Flavor Evaluation of Scrapple

Results tabulated in Table 5 shows the mean scores for flavor for each treatment sample. From the data, all samples - the control (Treatment 1), Treatment 2, 3 and 4 in terms of flavor were described by the panelists as having "recognizable meaty flavor".

An analysis of variance (ANOVA) using F-test for flavor at the 0.05 level of significance revealed that at least one sample may have caused a significant difference from among scrapple products. Results of the FLSD showed that Treatment 4 utilizing 100% chopped banana pseudostem core was significantly different from Treatment 1(Control), Treatment 2 (50% Ground pork : 50% Chopped banana pseudostem core) and Treatment 3 (25% Ground pork : 75% Chopped pseudostem core). The results indirectly confirmed that Treatments 2 and 3 are as good as the control (Treatment 1).

According to Mohapatra, et. al (2010) banana pseudostem is composed of soluble and insoluble fibers. The core or pith is rich in polysaccharides and other trace elements but lower in lignin content. The result indicated above coincide with the findings of Chang and Carpenter (1997); Desmond and Troy (2003) as cited by Biswas, et.al (2011), which states that fiber has neutral flavor. They have reported that oat bran and oat fiber provide the flavor, texture and mouth feel of fat in ground beef and pork sausages. Moreover, according to Besbes et.al (2008) the use of water and dietary fibers from pea and

wheat in replacement of meat in beef burger patties improved water binding capacity, thus increased the cooking yield, decreased shrinkage and lowered the cost of production without degradation of sensory properties.

Texture Evaluation of Scrapple

The taste of scrapple is surprisingly good-like country-style pork sausage with a unique shape and texture. It's a deck of cards sized slab, crispy on the outside, soft inside (Kerrigan, 1998). Mean scores for texture evaluation of scrapple are presented in Table 6. Among the samples evaluated by the panelists, Treatment 3 samples achieved the highest mean score of 4.68 which was rated descriptively as having a "Very crispy crust and soft texture inside", followed by Treatment 2 with mean score of 4.55 and which was descriptively evaluated the same as that of Treatment 3. On the other hand, the control (Treatment 1) and Treatment 4 were both perceived as having "Moderately crispy crust and soft texture inside".

Results of analysis of variance (ANOVA) at the 5% level of significance showed that a significant difference existed among treatment means. Follow up test using FLSD at the 0.05 level of significance revealed that in terms of texture, Treatment 4 is significantly different from the control (Treatment 1), Treatment 2 and 3. In addition, the control (Treatment 1) was found to be significantly different from Treatment 3 but not from Treatment 2. This finding expressed that Treatment 3 is comparable to the control (Treatment 1) in terms of texture.

Grigelmo-Miguel et al. (1999) as cited by Biswas, et. al (2010), pointed out that dietary fiber when incorporated to meat products do not just give beneficial effect to human health but also increases the bulk and prevents cooking loss with no or fewer changes in textural properties by enhancing water binding capacity. Furthermore, according to Todd et al (1989), addition of cellulose to processed meats improved texture.

Overall Acceptability of Scrapple

Texture, appearance and flavor are the three major components of food acceptability (Biswas, Kumar, Bhosle, Sahoo and Chatli, 2010).

Results tabulated in Table 7 shows the mean scores for overall acceptability for each treatment sample. From the data, Treatment 3 (25% Ground pork :75% banana pseudostem core) obtained the highest mean score of 4.60, and was perceived as "Highly Acceptable" followed by Treatment 2 (50% Ground pork :50% banana pseudostem core) with mean score of 4.43 which was evaluated as "Moderately acceptable". The mean scores of both samples were higher than the control (Treatment 1) with mean score of 4.42.

An analysis of variance (ANOVA) using F-test for overall acceptability at the 0.05 level of significance revealed that at least one treatment sample may have caused a significant difference from among scrapple samples. Follow-up test using the Fischer's Least Significant Difference (FLSD) at the 0.05 level of significance shows that Treatment 4 utilizing 100% chopped banana pseudostem core differed significantly from Treatment 1(Control), Treatment 2 and Treatment 3. This finding entails that samples of scrapple using 50% and 75% of banana pseudostem core were

comparable to the control and acceptable to the panel of tasters.

According to Anthony (2011), the fiber ingredients incorporated in the product are barely recognized by consumers, and actually improve flavor, texture and the stability of the final product. Furthermore, changing of fiber contents to improve quality of products hardly affects taste, texture or other parameters that traditionally influence consumer acceptance

Shelf life Evaluation of the Most Acceptable Scrapple using 75% Banana Pseudostem Core

The product with the highest rating (most acceptable) in terms of overall acceptability was subjected to shelf life determination. As shown in Table 7, the sample of scrapple with 75% banana pseudostem core (Treatment 3) was most preferred by the panel of evaluators. The said sample was stored at refrigerated temperature (4^{o}C). Microbiological analysis, physico-chemical analysis and sensory evaluation (color and odor) of raw samples were conducted until the product became spoiled or unacceptable. This is to determine the accurate shelf life of the product.

Sensory Evaluation, Physico-chemical analysis and Microbial Counts of Scrapple using Banana Pseudostem Core

Sensory evaluation to determine the shelf life of food products are routinely conducted in food experimentation as a part of each product development program (Freitas and Costa, 2006). Moreover, shelf life is a combined measure of both food quality and food safety of a product and therefore the microbial testing during shelf life trials must be designed to demonstrate both of these measures (www.ils-limited.co.uk/micro/shelf-life).

At selected interval during storage, the product was tested for total aerobic bacteria, viable *Escherichia coli*, *Enterobacteriaceae* and *Staphylococcus aureus*. The initial population of aerobic bacteria was 1.85 log CFU/g and for *Escherichia coli*, *Enterobacteriaceae* and *Staphylococcus aureus*, no growth was being observed until the endpoint of storage.

Figure 2 shows the trend of the Aerobic Plate Count (APC) for scrapple with 75% banana pseudostem core stored at 4^{O}C. The aerobic bacteria exhibited an appreciable increase from day 1 until the endpoint of storage. After two weeks of storing the product at 4^{o}C, it was noted that the product was still edible as evidenced by (1) Aerobic Plate Count (APC) result with a total population of 2.40 log CFU/g (2) the sensory evaluation result of raw sample which was perceived as having pleasant aroma with no sour odor detected and (3) its pH value of 6.0 shown in Figure 3 which

was still within the standard pH range of scrapple product. According to Adekunle, Porto-Fett,Call, Shoyer,Gartner, Tufft and Luchansky (2009), the pH range value of

Table.6 Mean sensory score for texture of scrapple using banana pseudostem core as meat filler.

Treatment	Replication			Total	Mean*	Descriptive Rating
	1	2	3			
Control	4.50	4.30	4.40	13.20	4.40[b]	Moderately crispy crust and soft texture inside
50%:50%	4.75	4.30	4.60	13.65	4.55[ab]	Very crispy crust and soft texture inside
25%:75%	4.75	4.55	4.75	14.05	4.68[a]	Very crispy crust and soft texture inside
100% BPC	4.30	3.75	4.15	12.20	4.07[c]	Moderately crispy crust and soft texture inside
Grand Mean					**4.43**	

*Significant. Column means followed with the same letter superscript are not significantly different at 5% level by FLSD.

Table.7 Mean sensory score on overall acceptability of scrapple using banana pseudostem core as meat filler.

Treatment	Replication			Total	Mean*	Descriptive Rating
	1	2	3			
Control	4.45	4.30	4.50	13.25	4.42[a]	Moderately acceptable
50%:50%	4.55	4.35	4.40	13.30	4.43[a]	Moderately acceptable
25%:75%	4.65	4.55	4.60	13.80	4.60[a]	Highly acceptable
100% BPC	3.95	3.70	3.65	11.30	3.77[b]	Moderately acceptable
Grand Mean					**4.30**	

*Significant. Column means followed with the same letter superscript are not significantly different at 5% level by FLSD.

Figure.2 Microbial count of microorganisms (APC) vs Storage time (days)

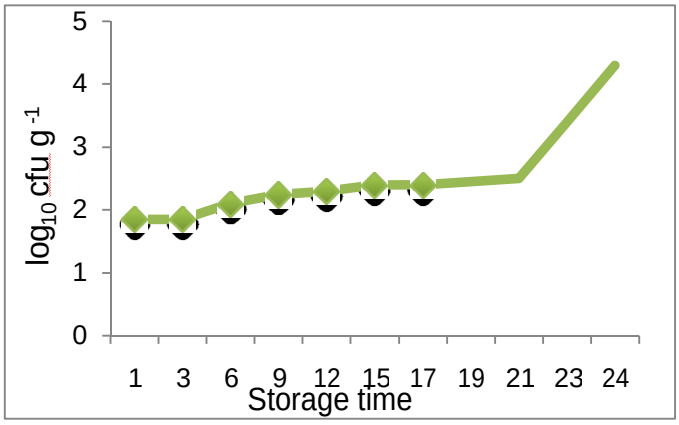

Figure.3 pH vs. Storage time (days)

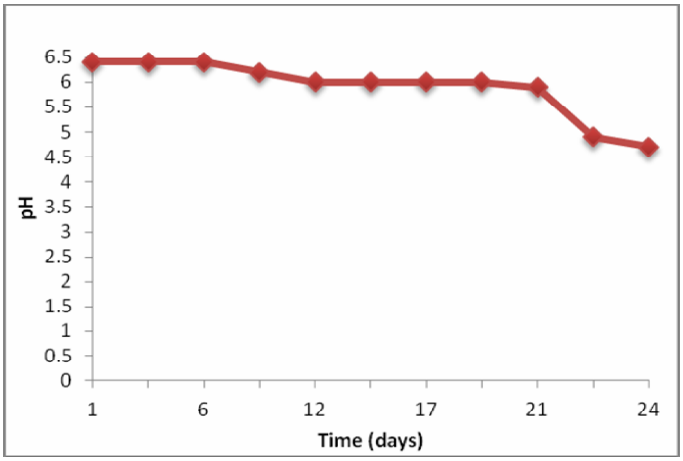

Table.8 Proximate composition, pH and salt content of scrapple

COMPONENT	Quantity	
	Pork Scrapple	Scrapple with BPC*
Ash (g/100 g)	1.93	2.1
Carbohydrates (g/100 g)	13.34	25.8
Fat (g/100 g)	6.68	2.4
Moisture (g/100 g)	70.28	64.0
Protein (g/100 g)	7.9	5.7
Salt (g/100 g)	1.11	1.0
	6.4	6.4

*Banana Pseudostem Core

scrapple product is between 5.1 to 6.4. The results above coincided with the data obtained after two weeks of evaluating the organoleptic properties of the product. Moreover, The Aerobic Plate Count (APC) of the product for 21 days of storage reached to 2.45 log CFU/g and was still considered safe to eat. Nevertheless, the product started deteriorating after 21 days in which the total population of aerobic bacteria reached to 3.40 log CFU/g and sour odor was already detected.

Scrapple is a Ready-to-eat (RTE) product with an extended refrigerated shelf life of 50 days having sodium citrate and sodium diacetate as antimicrobial components and vacuum-packaged at the same time (Adekunle,Porto-Fett, Call,Shoyer, Gartner, Tufft, and Luchansky, 2009). However, based on the shelf life study conducted on scrapple with 75% banana pseudostem core, stored at refrigeration temperature ($4^{O}C$), packed in polypropylene plastic and without preservatives added, it was found that the product is safe and consumable only for a maximum of 19 days.

Table.9 Economic analysis of scrapple using 75% banana Pseudo stem core and pork scrapple

Particulars	Treatment	
	Control (Php)	**25%:75% (Php)**
A. Ingredients		
Cooked Ground Pork 400g	56.00	-
Cooked Ground Pork 100g		14.00
Chopped pseudostem core	-	-
Meat Stock 350 g	2.00	2.00
Cornmeal 250 g	8.75	8.75
Salt 15 g	0.30	0.30
Black pepper 1.56g	0.34	0.34
Nutmeg 0.30g	0.38	0.38
Celery 0.30g	0.12	0.12
Onions 0.50g	0.78	0.78
Sub Total A	**68.67**	**26.67**
B. Other Expenses		
Fuel/LPG	14.50	14.50
Plastic (PP)	1.00	1.00
Labor	50.00	50.00
Sub Total B	**65.50**	**65.50**
Total Production Cost (A+B)	134.17	92.17
Total Yield (grams)	968.5	995.0
Price per gram	0.37	0.37
Total Sales	**358.35**	**368.15**
Net Profit	**224.18**	**275.98**
Net Profit of Treatment 3 vs. Control (N_{T3}-N_C)	**51.80**	

N_C = **Net Profit**$_{Control}$ N_{T3} = **Net Profit**$_{Treatment\ 3}$

Proximate Composition of Scrapple using Banana Pseudostem Core

Proximate analyses conducted for scrapple using 75% banana pseudostem core revealed that the product contained 64% moisture, 5.7% protein, 2.4% fat, 25.8% carbohydrates, 2.1% ash, 1.0% salt and a pH of 6.4 as shown in Table 8. Comparison of scrapple using 75% banana pseudostem core with that of pork scrapple confirmed that with the exception of pH (6.4), a variation in the quantity of components existed. The inclusion of 75% banana pseudostem core in the processing of scrapple significantly affected the components found in the product. Pork scrapple has only 13.34% carbohydrates content whereas scrapple with 75% pseudostem core has 25.8% which categorically confirms that scrapple using 75% banana pseudostem core is healthier than pork scrapple. Moreover, in terms of fat content the latter has only 2.4% while the former has 6.68%. Also, a minimal reduction in protein was revealed. On the other hand, the incorporation of banana pseudostem core in the preparation of scrapple did not affect the pH of the product. However, the moisture content of the product decreased from 70.28% to 64%. The decline can possibly be due to the presence of fiber.

The result was justified by the findings of Huang, Tsai and Chen (2009). They have reported that addition of wheat, oat and inulin dietary fiber to Chinese-style sausage lowers the moisture content of the product.

Cost Analysis

Table 9 shows the cost analysis of Treatment 1 (Control) and Treatment 3 (25% pork and 75% banana pseudostem core).

The incurred expenses for raw mat, spices and other costs in preparing the products are also reflected in Table 9. The total cost of production for Treatment 1 (Control) and Treatment 3 (75% banana pseudostem core) was P134.17 and P92.17, respectively. Scrapple with 75 percent banana pseudostem core (Treatment 3) has a net profit of P275.98, which is higher than the net profit of the control which is P224.18. Moreover, Treatment 3 obtained a value of 299.42% in terms of the Return On Working Capital, higher than Treatment 1(Control)

$$\textbf{ROWC (Control)} = \frac{224.18}{134.17} = 1.6708 \times 100 = 167.08\%$$

$$\textbf{ROWC (25\%:75\%)} = \frac{275.98}{92.17} = 2.9942 \times 100 = 299.42\%$$

The lowered ( ) ↓cost of production percentage for Treatment 3 was determined using the formula below:

$$\% \text{ Cost of Production} = \frac{CP_{Control} - CP_{Treatment}}{CP_{Control}} \times 100$$

$$= \frac{134.17 - 92.17}{134.17} \times 100$$

$$= \frac{134.17 \downarrow}{42.00} \times 100$$

% Cost of Production (Treatment 3) =

31.30%

Based on the data gathered during the

conduct of the study, the following conclusions were drawn: The utilization of pseudostem core in lieu of pork in the preparation of scrapple was possible, specifically the 25% pork: 75% banana pseudostem core proportion (Treatment 3). The said formulation was comparable to the control in terms of color, odor, flavor and texture. With regard to overall acceptability, Treatment 3 was evaluated as highly acceptable by the panelists.

Based on the microbiological, physico-chemical (pH and salt content) and sensory analyses conducted, the product can last only for a maximum of 21 days. A shelf life of 19 days was declared because of unforeseen drastic condition that may affect the quality of product during storage.

Proximate analysis revealed that scrapple with 75% banana pseudostem core contains 64% moisture, 5.7% protein, 2.4% fat, 25.8% carbohydrates, 2.1% ash. This only means that the product is a healthy food.

In terms of ROWC as economic parameter, Treatment 3 was 132.34% higher than the Control. This means a higher net profit and lower cost of production. The net profit of Treatment 3 was P 51.80 higher than the control (Table 9) and cost of production was lowered by 31.30%.

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