CHEMICAL, COOKING AND SENSORY CHARACTERISTICS OF BURGER PATTIES WITH DIFFERENT LEVELS OF BANANA PEDUNCLE POWDER

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ABSTRACT

Burger patties with different levels (0.0, 0.5, 1.0, 1.5 and 2.0%) of banana peduncle powder (BPP) were processed to evaluate the effect on the chemical composition, cooking recovery, sensory characteristics and cost of production. The chemical composition such as moisture, crude fiber and nitrogen-free extract contents were similar among treatments. The ash, crude fat and potassium contents generally increased while crude protein decreased with increasing level of BPP. Results of the evaluation showed that the cooking recovery was not affected by the treatment. Sensory evaluation revealed that all parameters considered were similar, except for off -flavor. Considering all the sensory parameters evaluated, the inclusion rate of up to 1% can produce a product with similar palatability as that of the control. There was a 3.2% reduction in the cost of production of patties with every 0.5% BPP substitution in the product.

Keywords: banana peduncle powder, burger patties, chemical composition, sensory characteristics

INTRODUCTION

Hamburger or burger has been one of the major processed meat products not only in the country but also all over the world. It is a very popular meal component or snack food for all ages. It is commonly served in a bread bun garnished with vegetables, cheese and different dressings. But due to the changes in the taste and lifestyle of the consumers, there emerge the so-called burger steak in some of the fast food chains in the country. This product, though, had been considered as one of the unhealthy foods since it is packed with high amount of unsaturated fatty acids which is often associated with heart ailments.

The emergence of several lifestyle diseases such as heart ailments, diabetes, cancer, obesity and others escalated the demand for health food products with preference for natural and organic sources of nutrients such as fruits and vegetables. The trend now in the manufacture of ready-to-eat foods in the country is to include a substantial amount of natural materials that can greatly improve the

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nutritional value by increasing the vitamin and mineral contents, and functional value by increasing the fiber contents of the product.

In recent years, the importance of food fibers has led to the development of a large and potential market for fiber-rich products and ingredients. Finding new sources of dietary fiber that can be used as ingredients in the food industry is now prevalent (Chau and Huang, 2003). Dietary fibers are incorporated in many food products for their nutritional, functional and technological properties. The technological effect on foods differs according to the quantity and nature of dietary fiber (Thebaudin *et al*., 1997). Fiber has been successful in improving cooking yield, reducing formulation cost and enhancing texture (Akoh, 1998; Iyengar and Gross, 1991). It has been used by the meat industry to improve the cooking yield and texture of cooked meat products due to the higher water and fat holding properties of fiber (Cofrades *et al*., 2000). Dietary fibers based on pectins, cellulose, soy, wheat, maize or rice isolates and beet fiber have been found to improve the texture of meat products, such as sausages, patties and salami. They can be used in the preparation of low-fat products, such as hamburger, frankfurters, meat loaves, etc. Their inclusion in the meat matrix contributes to maintain its juiciness, which implies that the volatile compounds responsible for the flavor of the product are more slowly released (Chevance *et al*., 2000).

Banana, being one of the major crops in the country for decades, has been cultivated primarily for their fruit, leaves, and to a lesser extent for the production of fiber. However, numerous by-products were also produced which are usually being disposed. Every year, an estimated amount of 2.5 metric tons of banana peduncle are discarded and allowed to decompose in the plantation. Currently, studies on the utilization of banana peduncle as source of fiber for human food are being undertaken at the National Institute of Molecular Biology and Biotechnology, University of the Philippines Los Baños. Initial results showed a very high digestible fiber content of 56% and mineral of 9.95%. This study was conducted to evaluate the effect of adding different levels of banana peduncle powder on the chemical and sensory characteristics of burger patties.

MATERIALS AND METHODS

Burger patties with different levels of banana peduncle powder (BPP) were processed. Treatment 1 had no BPP and served as control while treatments 2, 3, 4 and 5 contained 0.5, 1.0, 1.5 and 2.0% BPP, respectively.

The BPP was obtained from Cavendish banana peduncle harvested from a local contract grower from Davao del Sur in Southern Philippines. The peduncle samples were washed, peeled, soaked in metabisulfite solution, cut into cubes, passed through a mechanical presser and dried at 65°C for 6-12 hours. The samples were then milled in a Wiley mill with 200 mesh screen and passed through a 1 mm sieve. Pesticide residue in the peduncle was kept to a minimum since harvesting of banana coincides with the pest management schedule of the plantation and growing banana bunches were kept bagged until harvesting. The chemical composition of the BPP used in the study is shown in Table 1.

Table 1. Chemical composition of banana peduncle powder used in the study*.

Composition	Amount,%
Moisture	5.24
Ash	9.95
Crude Protein	5.29
Crude Fiber	42.64
Dietary fiber	56.00
Crude Fat	0.99
Carbohydrates	35.89
Sodium	0.11
Potassium	3.90
Calcium	0.055
Phosphorus	0.075

*Analyzed at the Central Analytical Service Laboratory, BIOTECH, UPLB.

The formulations used are presented in Table 2. Three (3) batches of 3 kg mixture per batch for each treatment were processed. Each batch served as a replicate. The different meat materials and non-meat ingredients used came from the same batch to minimize variation in the characteristics. The different ingredients were mixed together and were allowed to chill prior to molding into patties of about

Table 2. Burger patties' formulations with different levels of banana peduncle powder.

Ingredients, g	Treatment				
	1	2	3	4	5
Beef	440.0	410.0	380.0	350.0	320.0
Pork	150.0	150.0	150.0	150.0	150.0
Pork Fat	150.0	150.0	150.0	150.0	150.0
Salt	15.0	15.0	15.0	15.0	15.0
Sugar	20.0	20.0	20.0	20.0	20.0
Spices	2.0	2.0	2.0	2.0	2.0
Binder	34.0	34.0	34.0	34.0	34.0
Fresh Onion	56.0	56.0	56.0	56.0	56.0
Fresh Egg, 1 whole	45.0	45.0	45.0	45.0	45.0
Egg Yolk, 2 pcs	38.0	38.0	38.0	38.0	38.0
Water	50.0	75.0	100.0	125.0	150.0
Banana peduncle powder	0.0	5.0	10.0	15.0	20.0
TOTAL	1000.0	1000.0	1000.0	1000.0	1000.0

40 g. The patties were then immediately stored in the freezer prior to analyses. The patties from each treatment were divided and allotted to chemical analysis (10%) and sensory evaluation (90%).

Samples from the different treatments were cooked under low flame in a nonstick frying pan for about 7 min and the cooking yield was noted. The cooked samples were then prepared for sensory evaluation. About 15 g of cooked samples from the different treatments were randomly arranged in a pre-coded tray and were served to an experienced panel of evaluators. The sensory characteristics such as flavor, off-flavor, tenderness and juiciness were evaluated using a 9-point qualitative scale. The proximate compositions of the products were determined following the AOAC, 1990 procedure. Potassium and calcium were analyzed by atomic absorption spectrophotometry using AAnalyst 400 (Perkin Elmer, Waltham, MA, USA). All analyses were replicated three times.

The cost of production was determined by considering all the material inputs plus PhP. 14.00/kg product for the cost of labor, equipment depreciation, water, electricity and storage fee.

Cooking recovery and chemical composition were analyzed using the analysis of variance in completely randomized design (CRD) while the results of the sensory evaluation were subjected to statistical analysis using analysis of variance in randomized complete block design (RCBD). All treatment means were compared using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Cooking recovery

The cooking recovery of burger patties with different levels of BPP ranged from 89.32 to 92.22% (Table 3). Though samples with added BPP had generally higher cooking recovery than the control, results showed no significant differences among treatments. This trend agrees with Cofrades *et al*. (2000) who successfully demonstrated that dietary fibers improve the cooking yield of cooked meat products due to the fiber's water and fat holding properties. However, the result of this study is in contrast with the study of Briones (2009) who reported that cooking yield decreases as the level of carrot in the product increases, which is due to the differences in the characteristics of the material used in both studies.

Table 3. Cooking yield of burger patties with different levels of powdered banana peduncle.

Treatment	Cooking yield, %[ns]
1	89.32
2	91.39
3	91.61
4	91.30
5	92.22

ns: not significantly different at P>0.05

Chemical compositions

The chemical compositions of burger patties from the different treatments are presented in Table 4. The moisture, crude fiber and nitrogen-free extract were similar among treatments while ash, crude protein, crude fat and potassium contents were significantly different among treatments. The moisture content of burger patties from the different treatments ranged from 72.99-74.00%. The increasing level of water in the formulation as the level of BPP increased, did not affect the moisture content since there was a corresponding decrease in the amount of beef in the formulation and beef has about 74.24% moisture content (Ibarra, 1983). Generally, samples with BPP had significantly higher ash content than the control which may be attributed to the high mineral content of the BPP. However, the crude protein content decreased with increasing level of inclusion of BPP, agreeing with the studies of Canlas (2010) and Briones (2009). This trend can be attributed to the generally much lower protein content of plant materials compared to lean meat that they replace.

Table 4. Chemical compositions of burger patties with different levels of banana peduncle powder*.

Chemical composition	Treatment				
	1	2	3	4	5
Moisture, %^{ns}	72.99	73.35	74.00	73.15	72.84
Ash, %	2.77^{d}	3.77^{bc}	3.60^{c}	3.94^{ab}	4.12^{a}
Crude protein, %	12.40^{a}	11.47^{b}	10.48^{c}	10.86^{c}	10.46^{c}
Crude fat, %	7.75^{a}	5.87^{c}	6.09^{bc}	6.99^{ab}	7.37^{a}
Crude fiber, %^{ns}	0.46	0.53	0.51	0.65	0.68
NFE, %^{ns}	3.64	5.01	5.32	4.41	4.54
Potassium, %	0.49^{c}	0.66^{b}	0.77^{b}	0.78^{b}	0.97^{a}

Means within a row with different superscripts are significantly different at $P<0.05$.
ns: not significantly different at $P>0.05$

The crude fat content of samples from the control had significantly higher value than the rest of the treatments. As the level of BPP in the formulation increased, the amount of fat also increased, which could be due to the fat binding property of the BPP used. The crude fiber contents were not significantly different among treatments but showed an increasing trend with increasing level of added BPP in the product.

The potassium level significantly increased with increasing level of BPP since BPP itself has high amount of the said mineral. At 1% level of inclusion, considering a person 18 years old and above with a minimum daily potassium requirement of 2000 mg (FNRI, 2002), an 80 g serving size of burger patties would provide 616 mg potassium or equivalent to about 31% of the potassium requirement

for a day. Potassium was the only mineral determined since based on the earlier evaluations at the BIOTECH, UPLB, it is the only mineral of health importance that is present in significant amount in BPP. Generally, plant materials have higher mineral and fiber contents compared to meat which was also proven by the study of Llarena (2010) who obtained increasing amount of the said compositions as the level of inclusion of plant material increases.

Sensory characteristics

The sensory characteristics of burger patties from the different treatments are presented in Table 5. Except for off-flavor characteristics, all sensory parameters evaluated were not significantly different from each other, indicating that the treatment did not significantly affect those characteristics. The off-flavor score generally increased as the amount of BPP in the product increased. The level of up to 1% produced similar off-flavor score as that of the control, however, beyond that level, the increase in the level of off-flavor in the products became very evident. This is so since the inherent flavor of banana had become very intense in those products with higher level of inclusion which was perceived by the panelist as undesirable. In addition, the decreasing levels of beef in the formulation as the level of BPP increased may have contributed to the intensification of banana flavor in the products. Considering all the sensory parameters evaluated, the inclusion rate of up to 1% can produce a product with similar palatability as that of the control. This study is in contrast with Canlas (2010), who used *Moringa oleifera* leaves, and Llarena (2010), who used *Cucurbita moschata* fruit. Both reported improvement in the general acceptability of the products up to certain level of inclusion of the said plant materials.

Table 5. Sensory characteristics of burger patties with different levels of banana peduncle powder.

Treatment	Palatability characteristics				
	Flavor^{ns}	Off-Flavor	Tenderness^{ns}	Juiciness^{ns}	General acceptability^{ns}
1	6.94	1.06 c	7.28	7.06	7.33
2	7.24	1.26 bc	7.19	7.03	7.03
3	7.17	1.14 c	7.36	6.97	7.22
4	6.91	1.42 ab	7.55	7.25	6.89
5	6.86	1.53 a	7.61	6.97	6.89

Means within a column with different superscripts are significantly different at $P<0.05$.
ns – not significantly different at $P>0.05$.

Cost of production

The cost of production of burger patties decreased as the level of BPP increased (Table 6). There was a 3.2% reduction in the cost of production of patties with every 0.5% BPP inclusion. Considering the 1% level of inclusion being the

optimum, the cost of production can be reduced by as much as 6.4%, which is from P182.44 to P170.82. Similar with the previous studies (Llarena, 2010; Canlas, 2010; and Briones, 2009) which utilized vegetables in the production of frankfurters, the cost of production decreased as the level of non-meat ingredient increased.

Table 6. Production cost of burger patties with different levels of banana peduncle powder.

Treatment	Production cost/kg, PhP	Cost reduction, %
1	182.44	-
2	176.63	3.18
3	170.82	6.37
4	165.01	9.55
5	159.20	12.74

CONCLUSION

Results of the cooking yield, chemical composition and sensory evaluation showed that addition of banana peduncle powder of up to 1% can produce a product similar to the control. Further study on the utilization of banana peduncle powder on other processed meat products can be explored. In addition, study on the shelf life including the sensory and microbiological properties of products upon storage should be considered.

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