BIBLIOGRAPHY

BACAG, EVITA T. APRIL 2012. Physical and Chemical Properties of Smoked Pork using Guava and Alnus Wood as Smoking Material. Benguet State University, La Trinidad, Benguet.

Adviser: Sonwright B. Maddul, Ph. D.

ABSTRACT

The study was conducted at the Animal Genetic Resources (TANGERE) Project Laboratory of Benguet State University in Bektey, Puguis, La Trinidad, Benguet from December 2011 to January 2012 to evaluate the physical and chemical properties of smoked pork subjected to hot and cold smoke using guava and alnus wood as smoking material.

A total of 16 kilograms fresh pork was randomly allotted in a completely randomized design into the following treatments; hot smoking with alnus wood, cold smoking with alnus wood, hot smoking with guava wood and cold smoking with guava wood.

Result of the study was brought to DOST (CAR) Regional Standards and Testing Laboratory for quantitative determination of chemical properties of the pork product. Based on the result, the shrinkage percentage of the hot smoked pork using alnus wood was 45%, 8.5% in the cold smoked pork using alnus, 23.75% in hot smoked pork using guava and 3.5% in the cold smoked pork using guava. Based on 2,000 calorie diet, hot smoked pork using alnus can provide 220kcal/137g serving, cold smoked pork using alnus

can provide 154kcal/137g serving, hot smoked pork using guava can provide 172kcal/259g serving and cold smoked pork using guava can provide 102kcal/259g serving.

It is recommended cold smoking using guava be recommended for it results in lower shrinkage percentage and greater income. However, cold smoked pork has to be immediately consumed.

INTRODUCTION

The meat processing industry in the Philippines continues to grow as more investments are made by companies to expand their operations and produce world class products amid of intensifying global competition. To ensure continues growth of the industry, the Department of Agriculture (DA) has intensified several measures and policies to help the meat processing industry, amid the economic downturn. In support of the industry, Assistant Secretary Salvador Salacup said that the DA will relentlessly assist the processed meat industry by providing a conducive and healthy business environment through appropriate policies and programs (The Filipino Global Community, 2011).

The processed meat industry is participated in by large meat processors carrying well-known brand names, medium-scale meat processors, and small-scale or home-based processors (PCARRD, 1996). Animal meat is the most preferred source of proteins by Filipinos. Meat provides satiety unequaled by other food items. It can be prepared in several ways and its nutrients are almost in the proportion and amount needed by the human body. A nutritious food, meat is easily attacked by microorganisms; hence, it spoils rapidly at ordinary room temperature (PCARRD, 1991). Thus, it needs to be preserved if it is future use.

Meat preservation is lengthening the storage life of meat. The physical appearance, the chemical composition and consistency of the product may change but as long as its fitness for human consumption is lengthened, preservation is achieved. The basic principles of meat preservation are to prevent or lessen the microbial growth, atmospheric oxidation and enzymatic reaction that suppose to occur in the meat. There are different methods o f preservation and one of these is smoking (Arcellana, 2011).

Smoking is the process of subjecting meat to the action of smoke and heat generated by burning hardwood or sawdust. Traditionally, smoking is applied to meat products for preservation purposes. Smoke has high antimicrobial properties. A film of creosote formed on the meat surface acts as a barrier against the evaporation of moisture as well as the entry of insects and microorganisms to the product. The drying effect of the meat produced during smoking also aids in inhibiting and killing the microorganisms in the product (PCARRD, 1991).

According to Ibarra (1983), the effectiveness of smoking in meat preservation is therefore dependent on the dryness of the product, the thoroughness of smoking and the amount of smoke compounds that adhere to the meat surface.

The study was conducted to help the meat industry especially those who are in "etag" making. It can also help other researchers to come-up with follow-up researches. If it will be found satisfactory, it would give an additional knowledge to producers and even consumers on what chemical contents will hot and cold smoke pork using guava and alnus wood would improve the color of smoked pork. Also, it would encourage meat processors to invest on the product to put it into a commercial business.

Generally, this study was conducted to evaluate the smoked pork subjected to hot and cold smoke using alnus and guava wood as smoking material.

Specifically, the study aimed to determine the chemical contents of smoked pork including moisture, crude protein, crude fat and ash as affected by the two smoking materials, to calculate the nutrition facts per serving of the smoked pork and to determine the physical properties of the smoked pork in terms of pH value, shrinkage percentage, and color.

The study was conducted at The Animal Genetic Resources (TANGERE) Project Laboratory of Benguet State University in Bektey, Puguis, La Trinidad, Benguet. Chemical analysis of smoked pork was done at the DOST-CAR Regional Standards and Testing Laboratory in La Trinidad, Benguet.

REVIEW OF LITERATURE

According to the Philippine Bureau of Agricultural Statistics, the livestock industry grew by about 3 percent in 2003, with the hog sector as the major contributor. Hog production represents about 80 percent of the total Philippine livestock industry. In 2003, the swine sector grew by 4 percent. Due to continued strong domestic consumption of pork, hog production will likely continue to grow at a rate of 3 to 4 percent in 2004 and beyond despite increased feed cost in the world market. Filipinos are large consumers of swine meat and are known to generally prefer pork to chicken or beef (http://www.thepigsite.com/articles/?Display=1178). The flesh of animals prior to slaughter has a pH value of 7.1. After slaughtering, some of the glycogen in the meat turns into lactic acid. As a result, the pH value is lowered. The increasing acidity of the maturing carcass varies in its speed, depending on a number of factors such as type of animal, breed, rearing characteristics and treatment of the animal prior to slaughter. A high percentage of meat (especially pork, but also beef) does not follow the normal pH value curve after slaughter. This is mainly PSE (Pale, Soft, Exudative) and DFD (Dark, Firm, Dry) meat. With PSE meat, weak watery pale pork, the lowest pH value of about 5.8 is reached within one hour of slaughter. DFD meat, another meat whose characteristics vary from the normal, can lead to losses if it is incorrectly used for processing. This meat has first class water retention properties. The glycogen degradation in this meat is delayed or shortened. It reaches a lowest pH value of about 6.2 to 6.5. This meat is prone to decomposition from micro-organisms, and so is unsuitable for preparation of sausages from uncooked meat, for vacuum packaging of fresh meat, or for maturing. It is however ideal for the production of boiled sausages due to its water retention characteristics (http://www.eutechinst.com/techtips/tech-tips35.htm).

Pale, Soft, Exudative (PSE) condition is a quality problem most commonly affecting pork but which also affects beef, lamb, and poultry.PSE meat is characterized by its pale color, lack of firmness, and fluid (exudates) dripping from its cut surfaces. When cooked, this meat lacks the juiciness of normal meat. PSE meat is unsuitable for processed meats as well, as it results in pro ducts which have an undesirable pale color and are swimming in extra fluid (Forrest, 2011).

Meat is considered to be spoiled when it is unfit for human consumption. A variety of factors can cause meat to spoil including micro-organisms, exposure to air, and improper freezing techniques. Spoiled meat may be inedible due to unpleasant tastes and odors or may be unsafe for consumption especially when micro-organisms have caused the meat to spoil. Although a number of factors may contribute to meat spoilage, the most common cause of meat spoilage is the deterioration of meat caused by micro-organisms (bacteria, yeasts, and molds). Foods can contain dangerous bacteria and microorganisms but still have a normal appearance. Food which has not been handled or stored properly should not be eaten even if it has no apparent indications of spoilage (Forrest, 2011).

Meat preservation has been practiced for thousands of years, but marked changes have occurred in the processes applied as civilization has developed and technology increased. In early historic times, people learned to dry their supplies of fresh meat and fish in the sun and to store food for the cold winter months. Later they discovered how to smoke and salt these products to extend the time that the foods remained edible (Bennion and Scheule, 2004).

Smoking as Preservation Material

Smoking meat is an ancient and very popular method of preparing red meat or fish. The cooking technique helps preserve these protein-packed foods that would otherwise spoil. Smoking meat allows you to store it at room temperature because the smoke contains chemical compounds that stop the growth of harmful bacteria. Historians believe the act of smoking meat originated centuries ago with ancient man. Fish was the first meat smoked. The smoke possibly was a way to keep flies away during the drying process, but people soon realized it also doubled as a preservative. In ninth century in Poland, there is archeological evidence showing people smoked large amounts of fish (http://www.ehow.comfacts 7158416 history-smoking-meat.html).

Cold smoking is a process which smokes meat without exposing it to heat, usually at a temperature below 85 degrees Fahrenheit (30 degrees Celsius). During the cold smoking process, the smoke is usually generated in a chamber separate from the meat and passed through pipes so that it cools before it reaches the meat. Typically, the meat is held close to room temperature, and in relatively dry conditions. More intensely smoked meats are usually brined or salted before they are cold smoked. Salting the meat ensures that bacteria will not develop while it is cold smoked and stored (Wise Geek, 2003). In hot-smoking, the temperature in the smoke chamber ranges from 120°F to 180°F, which produces strong smoky flavor. However, the meat is usually only partially cooked and must be finished in a conventional oven (http://www.answers.com/topic/smoked-meat#ixzz1YxuGHUBO). In the Philippines, one ancient and indigenous technology of meat preservation that still exists is being practiced in the Cordillera. This is the "etag" making. "Etag", an ethnic product of the Cordilleran's, is a preserved meat using salt then dried either by sun drying or smoking (Ciano, 2010). “Etag” is also called by some locals as “inasinan” and “kinuday” while foreigners dubbed it as igorot ham and igorot smoked meat (Didican, 1995) cited by (Longboan, 2010).

Wood Smoking

In the late 1800s, a technique was developed to distill the smoke from burning wood to create “liquid smoke” which could be spread on cured meats to achieve the same flavor as the smoke house method. Today the use of liquid smoke is more common, and it saves time and minimizes air pollution. Although the additional flavor provided by “smoked” meats is preferred by some consumers, there is some concern about its posing a possible cancer risk regardless of the type of smoking used (Brown, 2005).

As cited by Price and Schweigert (1971), the chemical composition of smoke generated from the hardwoods is exceedingly complex. Among the chemicals that have been identified in smoke are aliphatic acids, ranging from formic through caproic; primary and secondary alcohols; ketones; formaldehyde, acetaldehyde, and other aldehydes; phenols; cresols; and a mixture of waxes and resins. Among this array of chemicals, formaldehyde and phenolics appear to be the chief bacteriostatic and bacteriocidal substances.

According to Brown (2005), in smokehouses, the intensity of the smoke, the humidity, and the temperature are all carefully regulated, and the type of sawdust or wood used to produce the smoke determines the products resulting flavor. Sawdust is the most economical and is often used by commercial processors, but other woods available for smoking include mesquite, hickory, oak, apple, and various combinations.

The type of wood used is responsible for the final color of the smoked product and it can be also influence its taste but only to a small degree. All fruit and citrus trees have a light to medium sweet flavor and are excellent with poultry and ham. Many say that cherry wood is the best. Oak, available all over the world, is probably the most commonly used wood for smoking. It produces a brown color. If hickory is used, the color will have a more vivid red tint in it (Domowe, 2011).

Guava Tree

A small tree to 33 ft (10 in) high, with spreading branches, the guava is easy to recognize because of its smooth, thin, copper-colored bark that flakes off, showing the greenish layer beneath; and also because of the attractive, "bony" aspect of its trunk which may in time attain a diameter of 10 in (25 cm). Young twigs are quadrangular and downy. The leaves, aromatic when crushed, are evergreen, opposite, short-petioled, oval or oblong-elliptic, somewhat irregular in outline; 2 3/4 to 6 in (7-15 cm) long, I 'A to 2 in (3-5 cm) wide, leathery, with conspicuous parallel veins, and more or less downy on the underside. Faintly fragrant, the white flowers, borne singly or in small clusters in the leaf axils, are 1 in (2.5 cm) wide, with 4 or 5 white petals which are quickly shed, and a prominent tuft of perhaps 250 white stamens tipped with pale-yellow anthers.The fruit, exuding a strong, sweet, musky odor when ripe, may be round, ovoid, or pear-shaped, 2 to 4 in (5-10 cm) long, with 4 or 5 protruding floral remnants (sepals) at the apex; and thin, light-yellow skin, frequently blushed with pink. Next to the skin is a layer of somewhat granular flesh, 1/8 to 1/2 in (3-12.5 mm) thick, white, yellowish, light- or dark-pink, or near-red, juicy, acid, subacid, or sweet and flavorful. The central pulp, concolorous or slightly darker in tone, is juicy and normally filled with very hard, yellowish seeds, 1/8 in (3 min) long, though some rare types have soft, chewable seeds. Actual seed counts have ranged from 112 to 535 but some guavas are seedless or nearly so. When immature and until a very short time before ripening; the fruit is green, hard, gummy within and very astringent. (Morton, 1987). According to Guava Wood Farms Hawaii (2011), guava wood has a subtle, semi-sweet aroma. The 100% organic cut wood is seasoned naturally under the Hawaiian sun for 9-12 months, then hand split and packaged to order for maximum flavor retention. Whether grilling or smoking, fresh chicken, pork, fish, lamb or beef, guava wood will complement each flavor nicely.

Alnus Tree

Alnus (*Alnus japonica Steud.)* also called Japanese alnus. Small-to medium-sized deciduous tree growing to a height of 15m. Leaves are alternate, narrow-elliptic, acuminate, and wedge-shaped at the base, up to 12 cm long, glossy and dark green above and pale underneath, the margins slightly toothed. Flowers are staminate, in long catkins; the pistillate flowers are in short catkins, becoming woody, with 5-lobe scales. Indigenous to Korea and grows in Baguio and other parts of the Mountain Province. Propagated by seed or grafting. Parts used are stem, bark and leaves. No reported folkloric medicinal use in the Philippines. Popular folk medicine in Korea, used for cancer, gastric disorders, hepatitis and fatty liver. Various species of alder, including this species, seem to contain antitumor compounds. Dye is obtained from the bark. Wood-close grained; used for turnery, charcoal.

MATERIALS AND METHOD

Materials

The materials used in this experiment included fresh pork, rock salt (NaCl), chopping boards, weighing scale, kitchen knives, stainless basin, guava leaves and trunks.

Method

Preparation of meat. A total of 12 kilograms of pork was obtained from a commercial pig available in a reputable meat stall at the La Trinidad Public Market. The meat was cut into 1-inch strips and washed in a basin. After draining, the meat pieces were placed in a basin for curing.

Curing or salting. For each kilogram of pork, 180 grams of salt was used for curing. The meat and salt was mixed thoroughly (Figure 1). The meat slices were properly arranged in a basin and was covered for 120 hours or 5 days. After 5 days, the cured meat was removed from the basin and undissolved salt particles were brushed off to prevent the appearance of objectionable white crust on the surfaces of the meat.

Figure 1.Pork slices that were cured

Cold smoking. The smoker was prepared by placing 9 kg of alnus and guava trunk: 1 kg of alnus and guava leaves for 1 day or 8 hours inside the fire pit. The smoke was allowed to go into the smoke chamber by means of a pipe connecting it with the fire pit. A notch was made at the end of the meat allowing for the insertion of abaca cord, which was hooked to the wire and was hanged in a smoker. After curing or salting, the meat strips was suspended above the safety baffle of the smoking chamber (Figure 2). The pieces of meat were not allowed to come in contact with one another in the smoking chamber to enable uniform penetration of smoke and even in color development. The temperature was maintained at 34°C for the duration of 56 hours (5days intermittent) at 8 AM to 4 PM. At the end of the day, the pork slices were kept in room temperature in the meat preservation laboratory.

Figure 2.Pork slices hanged inside the cold smoking chamber

Hot smoking. The smoker was prepared by placing 9 kg of alnus and guava trunk: 1 kg of alnus and guava leaves inside the fire pit. Air intake was adjusted to regulate the fire and burning wood. A notch was made at the end of the meat allowing for the insertion of an abaca cord, which was hooked to the wire and was hanged in a smoker (Figure 3). A safety baffle was placed over the fire pit to prevent flames from reaching the smoke chamber. The pieces of meat were not allowed to come in contact with one another in the smoking chamber to enable uniform penetration of smoke and even in color development. The temperature was maintained at 75°C. Duration of hot smoking is 16 hours (2 days intermittent at 8AM to 4 PM).

Figure 3.Pork slices hanged inside the hot smoking chamber

The smoking material served as an experimental treatment which was replicated six times. One kilogram of cured ham was considered as replicate. The treatments were as follows:

Treatment	Smoking Material
T_1	Hot smoking with alnus wood
T_2	Cold smoking with alnus wood
T_3	Hot smoking with guava wood
T_4	Cold smoking with guava wood

Chemical analysis. Samples of the meat product were brought to the DOST-CAR Regional Standards and Testing Laboratory for quantitative determination of physical and chemical properties of the meat product. Each sample weighing approximately 250 grams was tested for the presence of chemicals. The samples were wrapped individually in an aluminum foil and were packed in a zip lock plastic bag and were labeled accordingly.

Sanitation and hygiene. To prevent or minimized microbial contamination, good hygienic practices in meat processing and handling of smoked products (DOH, 2004) was observed as follows:

1. Maintaining adequate personal cleanliness.
2. Wearing adequate garments, and hand gloves.
3. Washing hands before starting work and repeatedly during work.
4. No rings, watches and bracelets shall be worn during work.
5. Cleaning/ Disinfection of tools, knives, chopping boards, utensils, and other materials for meat handling.
6. Taking any other necessary precautions to protect against contamination of meat and finished product.

Data Gathered

1. Fresh weight (g). The weight of the salted pork before it was subjected to drying.
2. Weight after smoking (g). The weight of the salted meat after it was dried.
3. Amount of salt applied (g). The amount of salt used in curing the meat.
4. Color. It was determined by ocular observation of the smoked product.

5. Nutrient analysis. The amount of the carbohydrates, crude fat, crude protein, moisture, energy and minerals (ash) that were analyzed at the DOST-CAR Regional Standards and Testing Laboratory.

5.1. Ash by gravimetric method (AOAC Method No. 920.05)

5.2. Crude fat by Soxhlet extraction (AOAC Method No. 920.39)

5.3. Crude protein by Kjeldahl method (AOAC Method No. 981.10 and in Accordance with 2000 Digestion System and Kjeltec 1002 Distilling Unit Instruction Manual.)

5.4. Moisture by oven method (AOAC Method No. 934.01).

5.5. Carbohydrate by calculation (FNRI-DOST Handbook).

5.6. Energy by calculation (FNRI-DOST Handbook).

Data Computed

1. Shrinkage percentage. It was calculated by subtracting the initial weight to final weight divided by initial weight then multiplied to 100 percent.

2. Nutrition facts. Amount of calories, calories from fat, total fat, sodium and protein were analyzed at the DOST-CAR Regional Standards and Testing Laboratory.

3. Total cost of production (TCP). This was computed by adding the cost of the meat and ingredient.

4. Return on investment. This was obtained by dividing the Net Income by the Total Cost of Production and multiplied by 100.

Statistical Analysis

The data on shrinkage was analyzed for difference using the analysis of variance. The Duncan's Multiple Range Test (DMRT) was used to determine significant differences between treatment means.

RESULTS AND DISCUSSION

Color of the Smoked Pork
as Affected by Smoking Material

Figure 4 shows the color of the smoked pork using guava and alnus wood as smoking materials in the study. The color of the pork subjected to cold smoking using guava and alnus as smoking materials was more or less similar to each other unlike to the pork subjected to hot smoking using the two smoking materials where there was a great difference. Hot smoked pork using guava wood had a better reddish brown color than the hot smoked pork using alnus with a grayish brown color. This difference can be attributed to the structure of the meat subjected to hot smoke using alnus. According to Brown (2005), cooking meat initially converts the color of raw meat to bright red, but then the denaturing of the pigment- containing proteins yields the classic color of well-done meat grayish-brown.

Figure 4. Hot smoked pork (left) and cold smoked pork (right) using alnus wood

Figure 5. Hot smoked pork (left) and cold smoked pork (right) using guava wood

<u>Shrinkage Percentage</u>

Table 1 shows the loss of moisture from the smoked meat as affected by smoking with either guava or alnus wood. The loss of moisture on the smoke pork's especially on the hot smoked pork's is due to the application of smoke and heat during smoking.

Table 1.Shrinkage percentage of the four smoked pork

TREATMENT	SHRINKAGE MEAN*
Hot smoking with alnus wood	45.0^{a}
Cold smoking with alnus wood	8.50^{c}
Hot smoking with guava wood	23.75^{b}
Cold smoking with guava wood	3.5^{c}

*Means with common letters are not significantly different at 5% level (DMRT)

According to Brown (2005), another contributing factor to meat shrinkage is the freeing of some water as the meats other proteins denature and lose their water holding capacity.

Statistical analysis revealed that pork subjected to hot smoking had a higher shrinkage than those pork subjected to cold smoking. This result on the cold smoked pork can be associated to the presence of creosote as a component of smoke. As cited by Ibarra (1983), during smoking, a coat of creosote at the surface of the meat is formed. This film at the outer portion of the meat acts as a barrier against the evaporation of moisture and entry of insects and microorganisms to the product. However, it is shown in the table that there were no significant differences on the cold smoked pork. In the hot smoked pork using alnus, it had a greater shrinkage percentage than the hot smoked pork using guava. This result can be credited to temperature during the conduct of the study.

Nutrient Composition Analysis

Table 2 shows the nutrient composition of the smoked pork samples specifically for the values of ash, carbohydrate, crude fat, crude protein, moisture, energy and sodium. The nutrient composition was obtained from one sample per treatment. No statistical analysis was done. Ash content of the smoked pork refers to the mineral residue left on the surface of the meat after it was subjected to smoking. While the composition may have differed among treatment means, this cannot be attributed to the effect of smoking material but on the individual samples submitted for analysis.

Table 2. Nutrient composition analysis of the four smoked pork samples

TREATMENTS	NUTRIENT COMPOSITION						
	Ash, %w/w	Carbohy-drate,%w/w	CF, %w/w	CP, %w/w	Moisture, %w/w	Energy, kcal	Sodium, mg/100g
Hot smoking with alnus	21.62	0	5.26	43.24	34.05	220	5,784*
Cold smoking with alnus	9.11	0	7.15	22.43	65.83	154	2,632*
Hot smoking with guava	17.54	0	4.57	32.83	50.60	172	5,184*
Cold smoking with guava	6.64	0	1.68	21.76	71.54	102	1,875*

*Test result which is outside the laboratory's scope of accreditation.
Analyzed by the Regional Standards and Testing Laboratory of the Department of Science and Technology CAR, La Trinidad, Benguet
**137g/ serving for treatments hot and cold smoking with alnus wood and 259g/ serving for treatments hot and cold smoking with guava wood

Ash content of the smoke pork differed from each treatment with hot smoked pork using alnus having the amount of 21.62%w/w followed by hot smoked pork using guava with 17.54%w/w then by cold smoked pork using alnus with 9.11%w/w and the cold smoked pork using guava of 6.64%w/w. It is notable that the four smoked pork did not contain carbohydrate. In terms of crude fat, cold smoked pork with alnus had the amount of 7.15%w/w followed by hot smoked pork with 5.26%w/w then by hot smoked pork with guava of 4.57%w/w and cold smoked pork with guava of 1.68%w/w. For crude protein, hot smoked pork with alnus got the highest then by hot smoked pork using guava followed by cold smoked pork using alnus and lastly the cold smoked pork guava with the amount of 13.24%w/w; 32.83%w/w;22.43%w/w and 21.76%w/w respectively. Due to lower application of heat, the cold smoked pork with guava registered the highest moisture of 71.54%w/w followed by the cold smoked pork with alnus having 65.83%w/w, then by hot smoked pork using guava with 50.60%w/w and the hot smoked pork using alnus registering the lowest with 34.05%w/w. Lastly, the salt which contains too high especially on the two hot smoked pork having 5,784 mg/100g and 5184mg/100g using alnus and guava wood respectively.

The four smoked pork samples also had different values on the amount of energy with hot smoked pork using alnus at 220kcal, registering the highest followed by hot smoked pork using guava wood, 172kcal; cold smoked pork using alnus wood, 154kcal and the lowest is the cold smoked pork using guava wood having 102kcal only. The energy differences can be attributed to the part of the smoked pork sample submitted and that had been subjected to analysis whether it contains more on fat or on lean. According to Gamman and Sherrington (1994), as cited by Ciano (2010), the energy value of food depends on the quantities of carbohydrate, fat and protein in the food with the fat supplying the most energy.

Crude fat and crude protein values from the four smoked pork vary which can be associated to the lean and fat composition of the meat subjected to smoking. The values might also be affected by other contributing factors such as age, breed and nutritional status of the animal as a source of pork. Salt found on the smoked pork was the used amount of salt during curing which is 180 grams per kilogram of meat.

The nutrient composition may vary even if the same procedure in smoking is followed considering that the composition would vary depending on the proportion of lean to fat in meat samples submitted for analysis.

Nutrition Facts

Table 3 shows the nutrition facts per serving of the four smoked pork samples. The nutrition facts normally appear in food labels as prescribed by the Bureau of Food and Drugs of the Department of Health.

Amount of nutrients was based on a 137g serving at the hot and cold smoked pork using alnus wood and 259g serving at the hot and cold smoked pork using guava wood as smoking material. Percent daily values were also based on 2,000 calorie diet/day. Based on a 2,000 calorie diet, percent daily values that can be provided by one serving of hot smoked pork using alnus (137g) are 3.25% crude fat, 11.85% crude protein, and 11.0%% energy. For cold smoked pork using alnus, one serving (137g) can provide 4.4% crude fat, 6.15% crude protein, and 7.7% energy. In hot smoked pork using guava, one serving (259g) will also provide 5.33% crude fat, 17.01% crude protein and 8.6% energy. Cold smoked pork using guava in one serving (259g) can provide 1.96% crude fat, 11.27% crude protein and, 5.1% energy. The smoked pork did not contain a value of carbohydrate and the percentage of sodium was found exceeding the recommended intake of 500mg for 18 years old and above.

Table 3.Nutrition facts per serving of smoked pork

NUTRIENTS	MATERIALS AND METHODS OF SMOKING			
	ALNUS (HOT)	ALNUS (COLD)	GUAVA (HOT)	GUAVA (COLD)
Ash				
Amount (g)	29.62	12.4	45.43	17.20
%Daily Value (%)*	-----	-----	-----	-----
Carbohydrate				
Amount (g)	0	0	0	0
%Daily Value (%)*	0	0	0	0
Crude Fat				
Amount (g)	7.21	9.80	11.84	4.35
%Daily Value (%)*	3.25	4.4	5.33	1.96
Crude Protein				
Amount (g)	59.24	30.73	85.03	56.36
%Daily Value (%)*	11.85	6.15	17.01	11.27
Moisture				
Amount (g)	46.65	90.19	131.05	185.29
%Daily Value (%)*	-----	-----	-----	-----
Energy				
Amount (g)	220	154	172	102
%Daily Value (%)*	11.0	7.7	8.6	5.1
Sodium				
Amount (mg/100g)	5784	2632	5184	1875
%Daily Value (%)*	**	**	**	**

*Based on 2,000 calorie diet

**Amount is exceeding the recommended intake of 500mg for 18 years old and above

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This study was conducted to evaluate the chemical and physical properties of smoked pork subjected to hot and cold smoke using alnus and guava wood as smoking material. The study was conducted at the TANGERE Project Laboratory of Benguet State University in Bektey, Puguis, La Trinidad, Benguet from December 2011 to January 2012.

A total of 16 kilograms of pork from commercial pig was used in the study. Following the completely randomized design, four treatments were drawn having four replications with one kilogram of pork per replication. The data gathered on the physical properties of the smoked pork were shrinkage percentage and color and the chemical properties included ash, carbohydrate, crude fat, crude protein, moisture and energy content of the smoked pork.

Based on the result, the shrinkage percentage mean of the hot smoked pork using alnus wood is 45%, 8.5% in the cold smoked pork using alnus, 23.75% in hot smoked pork using guava and 3.5% in the cold smoked pork using guava. As to composition, protein content of the hot smoked pork were 43.24 and 32.83 in the hot smoked pork using alnus wood and hot smoked pork using guava, respectively. Energy content of the hot smoked pork using alnus is 220kcal/137g and 172kcal/259g in the hot smoked pork using guava wood, cold smoked pork with 154kcal/137g using alnus wood and 102kcal/259g in the cold smoked pork using guava wood. Crude fat content of the four smoked pork varied from 7.15%w/w in cold smoked pork using alnus wood, 5.26%w/w in hot smoked pork using alnus wood, 4.57%w/w hot smoked pork using guava wood and 1.68%w/w in cold smoked pork using guava wood. The protein content of hot smoked

pork using alnus is 43.24%w/w and 32.83%w/w in hot smoked pork using guava, 22.43%w/w in cold smoked pork using alnus and 21.76%w/w in cold smoked pork using guava.

Based on a 2,000 calorie diet, percent daily values that can be provided by one serving of hot smoked pork using alnus (137g) are 3.25% crude fat, 11.85% crude protein, and 11.0%% energy. For cold smoked pork using alnus, one serving (137g) can provide 4.4% crude fat, 6.15% crude protein, and 7.7% energy. In hot smoked pork using guava, one serving (259g) will also provide 5.33% crude fat, 17.01% crude protein and 8.6% energy. Cold smoked pork using guava in one serving (259g) can provide 1.96% crude fat, 11.27% crude protein and, 5.1% energy. The smoked pork did not contain a value of carbohydrate and the percentage of sodium was found exceeding the recommended intake of 500mg for 18 years old and above.

The four smoked pork did not contain a value of carbohydrate and the percentage of sodium was found exceeding the recommended intake of 500mg for 18 years old and above.

Conclusions

Based on the result of the study, the following conclusions were drawn:

a.) The four smoked pork had a high amount of sodium exceeding the recommended intake of 500mg for 18 years old and above.

b.) Hot smoked pork had a higher shrinkage percentage and had lower moisture retention than that of the cold smoked pork that had lower shrinkage percentage and had higher moisture retention.

c.) The energy or calorie and crude protein contents of the hot smoked pork were higher as compared to the cold smoked pork.

Recommendations

Based on the result of the study, the following recommendations are offered for consideration:

a.) It is recommended that alnus for hot smoking can be used for it contain high amount of energy with 220kcal/137g serving and a crude protein of 43.24%w/w.

b.) If the purpose of producing smoked pork is to generate income, cold smoked pork is recommended for it results in lower shrinkage percentage. However, cold smoked pork has to be immediately consumed.

c.) The same study could be done concentrating on the pH value and shelf-life of the smoked pork.

LITERATURE CITED

ARCELLANA, C.S.S. 2011. Lecture on "Meat Processing". Department of Animal Science, Benguet State University.

BENNION, M.; and B. SCHEULE, 2004. "Introductory Foods". Pearson Education, Inc., Upper Saddle River,New Jersey, #07458. P. 801.

BROWN, A. 2005. 2nd Ed., Understanding Food: Principles and Preparation, by S. R. Curtis. University ofMaryland Wadsworth. P. 266.

CIANO, E. 2010. Quality evaluation of "etag" making in Besao, Bontoc and Sagada, Mountain Province. MS Thesis. Benguet State University, La Trinidad, Benguet.

DOMOWE, W. 2011. WOOD FOR SMOKING. Retrieved July 2011 from http://www. wedlinydomowe.com/meat-smoking/wood.

FORREST, J. 2011. Meat Quality and Safety.Retrieved September 2011 from http:// ag.ansc.purdue.edu/meat_quality_problems.html

FORREST, J. 2011. Meat Quality and Safety.Retrieved September 2011 from http:// ag.ansc.purdue.edu/meat _quality/spoiled_meat.html

GUAVA WOOD FARMS HAWAII, 2010. Retrieved September 2011 from http://www.hawaiiguava.com/guava-smoking-wood.html

IBARRA, P.I.1983.Meat Processing for Small to Medium Scale Operations. College of Agriculture. College, Laguna. UPLB.

LONGBOAN, F. 2010. Evaluation of Salted meat ("etag") dried over slow fire using different kinds of wood.Undergraduate Thesis. Benguet State University, La Trinidad, Benguet.

MORTON, J.F. 1987. "In fruits of warm climates. Guava". Retrieved July 2011 from http://www.hort.purdue.edu/newcrop/morton/guava.html#Description

PCARRD, 1991. The Philippines Recommends for Meat Processing. Philippine Agriculture an d ResourceResearch Foundation, Inc. P. #3.

PCARRD, 1996. The Philippines Recommends for Pork Production. Philippine Agriculture and ResourceResearch Foundation, Inc. P. 84.

PRICE, J. F. and B. S. Schweigert, 1971. The Science of Meat an d Meat Products.2nd Edition. , W. H. Freeman and Company.

STUART, G. 2011. Philippine Medicinal Plant. Retrieved July 2011 from http://www.Stuartxchange.org/Arnus.html

THE FILIPINO GLOBAL COMMUNITY, 2011. Retrieved September 2011 from http://www.philstar.com/Articles.aspx?articlind=490703

WISEGEEK, 2011. clear answers for common questions. Retrieved September 2011 from http://www.wisegeek.com/what-is-cold-smoking.html