

BIBLIOGRAPHY

PANG-ETAN, LAARNI B. APRIL 2013. Acceptability of Different Herbs as Flavoring Agents for *Etag*. Benguet State University, La Trinidad, Benguet.

Adviser: Madeline S. Kingan, MSc.

ABSTRACT

The study was conducted at the Meat Processing Laboratory, Department of Animal Science, Benguet State University, La Trinidad, Benguet from October to November 2012. Following the Completely Randomized Design (CRD), 16 kilograms of meat from a newly butchered eight months old pig was equally divided into four parts to represent four treatments. Each treatment has four replications with one kilogram of pork per replication. The treatments were as follows: Control (T₀) - 150 g rock salt; (T₁) - 150 g salt + 30 g basil; (T₂) - 150 g salt + 30 g oregano; and (T₃) - 150 g salt + 30 g rosemary.

A total of 20 “*etag*” consumers were invited to evaluate the product. Data gathered from the evaluation revealed that “*etag*” cured with plain salt, salt with basil and salt with oregano were better in appearance, aroma, taste, flavor and overall acceptability compared to “*etag*” cured with rosemary plus salt. The shrinkage which resulted from slating and smoking was more or less similar across treatments while the cost of production varied with the prices of the herbs added to the curing mix.

It is therefore concluded that herbs like basil and oregano could be used to enhance the flavor of “*etag*”.



INTRODUCTION

Meat processing is a practice typically originated in the prehistoric period. The most common in this early age were salting, drying, and smoking. These early, the processed meat products were prepared for preservation for future use. Meat preservation is delaying or preventing storage through smoking or curing the meat. The purpose of curing meat is to convert the meat of animals into high quality cured meat products.

“*Etag*”, often termed as “*Igorot ham*”, is usually prepared during occasions like wedding, celebration of natal day, “*kanyaws*”, harvesting time and other occasions along with rice wine and other locally brewed alcoholic beverages. In Mountain Province, particularly the Western part, the dried salted meat called “*etag*” is an important ingredient to a native delicacy called “*pinikpikan*”. It is also cooked with legumes, or plain vegetables giving an exclusive aroma for the food.

Flavor is a complex one, referring to both odor and taste at the same time. Da Cunha (2007) stated that consumers are looking for different, trendy, and ethnic style meat products. Accordingly, the meat industry is trying more and more to top into these trends with the richness and complexity provided by flavoring agents.

Basil (*Ocimum basilicum*) belongs to family *Lamiaceae* (mints). It is an annual plant, a native of warm climates, about 30 cm (about 12 in.) high, with ovate stalked leaves that are oftentimes pointed. They are green in color, although some varieties feature hint of red or purple (Pogeyed, 2009).

Oregano (*Origanum vulgare*) is a perennial herb native to Europe, Asia and Mediterranean region that belongs to family *Lamiaceae*. It is an aromatic herb (that grows



up to 0.9 m) with hairy, opposite leaves and white or pink flowers congested towards the branch ends and has a bitter taste (Sandhyarani, 2011).

Rosemary (*Rosmarinus officinalis*) is a popular aromatic herb that can reach 1.5 (4 ft. 11 in.), rarely 2m (6 ft. 7 in.) and has an erect open habit, with narrow, aromatic, needle-like, evergreen leaves that are mid to dark green in color with pale green undersides. The tubular flowers, which range in color from white to blues, pink and mauves, are produced in small clusters at the leaf joints (McHoy, 2001).

The study was conducted to know which herb is the best flavoring agent and to encourage people in trying to process “*etag*” using these herbs because these are not just condiments but also have medicinal value.

People in today’s generation are more conscious about their health so they tend to search for so-called healthy foods. The researcher responds by adding healthful herbs to meat. If the result of this study will be satisfactory, the developed products can be commercialized by interested individuals.

Along with researchers growing interest in medicinal plants such as herbs and spices as alternative curative products, it is likewise interesting to try incorporating them into processed meat products.

This study was conducted to provide basic information to homemakers and food processors who are interested to engage in “*etag*” making and other processed products using basil, oregano and rosemary. Also, the result of the study serves as reference to other researchers for follow- up researches.



The study aimed to:

1. determine the acceptability of the product in terms of appearance, flavor, aroma, taste, and tenderness;
2. determine which herb is the best flavoring agent in making “*etag*”; and
3. determine the production cost of the processed “*etag*”.

The experiment was conducted at the Meat Processing Laboratory, Department of Animal Science, Benguet State University; La Trinidad, Benguet from October to November, 2012.



REVIEW OF LITERATURE

Description of Meat

Meat is a general source of the water soluble B complex group, Phosphorus, Potassium, and Iron but a poor source of Calcium, Vitamin C and Vitamin A, D, E and K. Pork contains higher levels of the B complex Vitamins than beef and poultry. Essential nutrients such as Iron, Zinc, Selenium, and Copper are found in the meat especially on the lean portion. It is also a good source of Iron and Phosphorous.

Smoking meat is exactly what the name implies: flavoring meat with smoke. Smoke composition is quite complex. They are made up of several groups of substances. Donoso (2007) cited that phenolic acids are the ones responsible for the flavor, and also have anti-oxidant and anti-bacterial properties. The acids work more in the physical properties and can also help in the curing process. The carbonyl compounds add some softness to the taste, but are most important by giving a golden brown superficial color, and a shiny aspect. The best way to cure, however, is by smoking the salted meat by the preferred wood with some herbal leaves for aroma and flavor.

Basil

Fragrant basil is an annual or short-lived perennial of subtropical and tropical regions in the Old World. Clearly marked mint family features are 4-sided stems, leaves opposite on the stem and small flowers arranged in whorls usually in a terminal spike. Each flower produces 4 nutlets or seeds. Some species show considerable variation in form, size, color and shape of leaves, and aroma; other species remain noticeably uniform. Absorption of essential oil mixtures produced in epidermal gland cells on the leaves are responsible



for variation in fragrance. Scents include anise, camphor, cloves, lemon, rose, floral, and thyme- all variously blended. Basil is said to deter flies; a bee plant. The essential oils are used in perfumery. Stored frozen leaves are more potent than dried. Dried basil leaves are used in a preparation of salt and spice- free dietetic meat products (Wrensch, 1992).

Medicinal uses and properties. Basil is widely used in traditional medicine as tonics and general medicines against indigestion, flatulence, loss of appetite and internal parasites. Sweet basil has been considered as useful diuretic since ancient times and is sometimes included in wound-healing ointment. Leaf infusions or fresh leaf juice of holy basil is used in India, mainly against cough, upper respiratory infections, stress related skin disorders and indigestion. The seeds are considered to be a nutritional tonic. The essential oil (up to 1%) of *O. basilicum* has methychavicol (estragole) and linalool as main component (both may reach 70% or more), together with eugenol, ocimene and cineole. Also present are tannins and flavonoids. Estragole is carcinogenic at higher doses, so basil should not be taken over long periods of time, or be given to pregnant women and young children (Wyk and Wink, 2004). Traditionally, basil has been used as a medicinal plant in treatment of headaches, coughs, diarrhea, constipation, warts, worms, and kidney malfunctions. It is also thought to be an antispasmodic, stomachache, carminative, stimulant and insect repellent. The oils of basil, especially the camphor-containing oil, have antibacterial properties. Volatile compounds produced by sweet basil have been shown to influence the composition, distribution, and spore germination of some fungal populations. The volatile terpenes camphor and 1, 8-cineole present in basil and other members of the Lamiaceae have been suggested as agents in allelopathic reactions (Simon, 1995).



Pogeyed (2009) mentioned that the nutrient content of 1 serving or 4 tablespoon of basil is as follows:

<u>Vitamins</u>	<u>Nutrient value</u>	<u>Minerals</u>	<u>Nutrient value</u>
Vitamin C (mg)	1.900	Calcium (mg)	16.00
Thiamin (mg)	0.003	Iron (mg)	0.34
Riboflavin (mg)	0.008	Magnesium (mg)	9.00
Niacin (mg)	0.098	Phosphorus (mg)	7.00
Pantothenic Acid (mg)	0.025	Potassium (mg)	49.00
Vitamin B₆ (mg)	0.014	Zinc (mg)	0.09
Folate (mcg)	7.000	Copper (mg)	0.03
Vitamin A (IU)	559.000	Manganese (mg)	0.15
Vitamin K (mcg)	44.000		
<u>Macronutrients</u>	<u>Nutrient value</u>	<u>Fatty acids</u>	<u>Nutrient value</u>
Calories (kcal)	3.00	Saturated fat (g)	0.004
Protein (g)	0.27	Monounsaturated fat (g)	0.009
Total Fat (g)	0.06	Polyunsaturated fat (g)	0.041
Total Carbohydrates (g)	0.46		
Dietary Fiber (g)	0.40		
Sugar (g)	0.03		

Culinary uses. Basil is used as condiment or spice; source of essential oil for use in foods, flavors, and fragrances; garden ornamental. The green aromatic leaves are used fresh and dried as flavorings or spices in sauces, stews, salad dressings, vegetables, poultry,



vinegar, confectionery products, and the liqueur chartreuse. Basil extract has been reported to have antioxidant activity. Cultivars with purple foliage, such as 'Dark Opal' and var. *auranascens*, are grown as ornamentals, but can also be used as flavorings. The essential oils and oleoresin are used extensively, reducing the need for dried leaves in the food industry; used in perfumes, soaps, and shampoos (Simon, 1995).

The essential oils of basil extracted via steam distillation from the leaves and flavoring tops are used to flavor foods, dental and oral products, in fragrances, and in traditional rituals and medicine. Extracted essential oils have also been shown to contain biologically-active constituents that are insecticidal, nematocidal, fungistatic or which have antimicrobial properties. These properties can frequently be attributed to predominant essential oil constituents, such as methyl chavicol, eugenol linalool, camphor, and methyl cinnamate. Two minor components of the essential oil of sweet basil, jovicimene I and II have been reported as potent juvenile hormone analogs. There are several types of basil oil in international commerce, each derived principally from different cultivars or chemotypes of sweet basil. The oils of commerce are known as European French or Sweet Basil, Egyptian, Reunion or Comoro; and to a lesser extent Bulgarian and Java basil oils. The European type of basil oil considered to be the highest quality, and producing the finest odor, characteristically contains: linalool; methyl chavicol; and to a lesser extent 1,8-cineole, alpha-pinene; β -pinene; myrcene; ocimene; terpinolene; camphor; terpinen-4-ol; alpha-terpineol; eugenol; and sesquiterpenes. Egyptian basil oil of commerce is similar to European basil oil except that the concentration of d-linalool is significantly lower while the concentration of methyl chavicol is significantly higher. In contrast, Reunion or Comoro basil oil contains little if any d-linalool and is a harsher, spicy oil due to the very



high concentration of methyl chavicol, and to a lesser extent, 1,8-cineole, borneol camphor and eugenol. Bulgarian and Java basil oils are rich in methyl-cinnamate and eugenol respectively. The essential oil content ranged from 0.04 to 0.70% (v/fresh weight) within the *Ocimum* germplasm collection. Chemotypes high in 1,8-cineole, trans- β -ocimene, camphor, linalool methyl chavicolgeraniol, citraleugenol, methyl cinnamate, methyl eugenol, β -caryophyllene, and elemene, and β -bisabolene were identified. Accessions varied in essential oil content, and showed diversity in growth, form, flowering and pigmentation (Simon, *et al.*, 1990).

According to Pogeyed (2009), basil is best used as fresh, because fresh basil has a stronger aroma than dried. The oil from this basil have also shown to repel insects and have larvicidal activity against houseflies and mosquitoes, camphor, d-limonene, myrcene and thymol are some of the compounds in the oil that may provide the repellent properties. Besides its uses in the kitchen and insect repellent, the essential oil that comes from basil is used in soaps, toothpaste, mouthwash and perfumes and even used fragrance of basil to decrease fatigue.

Oregano

Oregano (*Origanum vulgare*) means “mountain joy”, belonging to the family Lamiaceae, is a perennial herb native to Europe, Asia and Mediterranean region. It is a highly aromatic plant with a bitter taste. Plants that are closely related to oregano are Mexican oregano and marjoram. The amount of essential oils present in the oregano plant varies depending upon the species and growing conditions. Dried leaves of oregano are commonly used for the therapeutic purposes as well as for the culinary purpose to add flavor in pickles, sauces and various food preparations. Regarding the nutritional value of



oregano herb, it contains iron, vitamins, calcium, magnesium, copper, niacin and thiamin (Sandhyarani, 2011).

According to Wyk and Wink (2004), oregano is very similar to marjoram or sweet marjoram (*O. majorana*) and the two species (both culinary herbs) are often confused. Several species have been used in folk medicine, including *O. compactum*, *O. dictamnus*, *O. heracleoticum*, *O. onites* and *O. syriacum*. *O. syriacum* is the hyssop of the Bible (mentioned at the the Crucifixion). *O. dictamnus*, the dittany of Crete (or *dictamon* in Greek), has woolly leaves and large floral bracts. In Greek mythology, it is the herb that was used by Aphrodite to heal the wounds of the Trojan hero Aeneas. Oregano, sweet marjoram and dittany are mainly used to treat bronchitis, catarrh, cold and flu, colic and dyspepsia. These herbs or their dilute oils are sometimes used topically for mouth hygiene, to treat nasal congestion, wounds and itching skin. The essential oils of oregano and marjoram are used in aromatherapy. The essential oils of *Origanum*, species interfere with biomembranes and are known to be antibacterial, anti-fungal, antiviral, spasmolytic and anti-inflammatory. Oregano and dittany oil contains carvacrol (40%-70%), *p*-cymene and γ -terpinen, while marjoram oil mainly has terpinen-4-ol, α -terpineol, sabinen, linalool and carvacrol. Tea made from 1-2g of dried herb can be taken three times a day. The oil should never be taken internally.

In 2004, Holmes stated that oregano is a perennial cushion- forming herb with aromatic scented leaves; mostly hardy with range of golden, green and variegated foliage; *O. v. 'Album'* with white flowers; *O. v. 'Aureum'* with golden leaves excellent for spring effect and informal hedging; *O. v. 'Aureum Crispum'* attractive crinkled golden leaves tidier than type; *O. v. 'Compactum'* tidy green mound with excellent flavor, lasts well into winter;



O. v. 'Gold Tip' green leaves with attractive gold tips , excellent for edging; *O. majorana* (sweet marjoram) more delicately scented and flavored; *O. onites* (Greek oregano) thyme-like flavor; all excellent sweetly aromatic culinary herb.

Baggeo (2011) mentioned that the nutritive value per 100 g of oregano leaves is as follows:

<u>Minerals</u>	<u>Nutrient value</u>	<u>Vitamins</u>	<u>Nutrient value</u>	<u>Macro-nutrients</u>	<u>Nutrient value</u>
Calcium (mg)	1576.00	Choline (mg)	32.30	Energy (kcal)	306.00
Iron (mg)	44.00	Folate (mcg)	274.00	Protein (g)	11.00
Magnesium (mg)	270.00	Niacin (mg)	6.22	Total Fat (g)	10.25
Phosphorus (mg)	200.00	Vitamin C (mg)	50.00	Total Carbohydrates (g)	64.43
Potassium (mg)	1669.00	Vitamin E (mg)	18.86	Dietary Fiber (g)	42.80
Zinc (mg)	4.43	Vitamin K (mcg)	621.70		
Selenium (mg)	5.90				

Amrick and Bilkei (2002) stated that oregano stimulates organic and microbiological digestion. Carvacrol and thymol had an effect on the upper layer of mature enterocytes and accelerated the renewal rate of mature enterocytes at the surface of the villi of the intestine. This would reduce the pathogenic contamination of enterocytes and improve their capacity for nutrient absorption. Oregano supports digestion and the regulation of processes in the digestive tract of pig. It has been reported that in sows the essential oils of oregano act not only as alternative anti-bacterial performance promoters, digestion aids, and appetite



enhancers, increasing daily intake ($P < 0.05$), but, when used as natural feed additives, act also as enhancers of growth, reproductive performance, and milk production.

Oregano essential oil is one of the many plant extracts that are used at present as supplements in animal's diets. It contains mainly carvacrol, thymol and their precursors, and it possesses intense *in vitro* antimicrobial antifungal antioxidant properties, making it an appropriate candidate as a replacement for antibiotic growth promoters (Symeon, 2000). Oil pressed from oregano leaves that contain the active ingredient carvacrol may be an effective treatment against sometimes drug-resistant bacterial infection. Georgetown University researchers have found that oil of oregano appears to reduce infection "as effectively as traditional antibiotics". Oil of oregano at relatively low doses was found to be efficacious against Staphylococcus bacteria and was comparable in its germ-killing properties to antibiotic drugs such as streptomycin, penicillin and vancomycin. Earlier this year researchers at the Department of Food Science at the University of Tennessee reported that among various plant oils, oil of oregano exhibited the greatest antibacterial action against common pathogenic germs such as Staph, E. coli and Listeria. British researchers reported oregano oil had antibacterial activity against 25 different bacteria and a clinical study in Italy has shown that oil of oregano can be used to treat intestinal parasites (Sardi, 2001).

According to Leung (1996), oregano is a powerful antifungal, working in the GI tract as well as in the sinuses and lungs. It repeatedly has demonstrated the ability to obliterate yeast, including *Candida albicans*. It has been demonstrated to stop the production of a cancer causing fungal toxin, aflatoxin. No yeast species has been to demonstrate resistance to oregano oil.



Culinary uses. Oregano is a *condicio sine qua non* in Italian cuisine, where it is used for tomato sauces, fried vegetables and grilled meat. In Greece, oregano is one of the more popular herbs and usually employed in the dried state. Like in Italy, it is valued together with the acidic flavours of pickled olives and *feta* cheese, for example in the so-called Greek salad (*Choriatiki salata*). Moreover, oregano flavour grilled meats; it is used for the vertical rotating spit roast meat *gyros*, and also for its Turkish counterpart, *döner*; also, the charcoal-roasted skewered lamb pieces *souvlaki* are sprinkled with oregano. Outside the Mediterranean region, oregano is, rather surprisingly, little in use, except among Italian immigrants. The very similar, but stronger, taste of Mexican oregano is popular not only in its native country México, but also in the south of the US, where it is frequently used to flavour *chili con carne* (meat stewed with chiles and sometimes beans) or other México-inspired dishes (Katser, 2007).

Medicinal uses. In 2011, Sandhyarani stated that oregano plant has been used for the treatment of various diseases since thousands of years ago. Medical researches reveal that oregano contains antioxidant, anti-microbial and anti-parasitic compounds. Considering these medicinal properties, the studies are ongoing to use oregano for the treatment of severe diseases such as heart disease and muscular degeneration. An antioxidant nature of oregano is evident from the presence of thymol and rosmarinic acid. These compounds help in scavenging free radicals, thus preventing cell damage and membrane alteration. The amount of antioxidant present in a tablespoon of fresh oregano and a medium-sized apple are the same. The volatile oil carvacrol present in oregano inhibits the growth of bacteria, and other parasitic microorganisms. Some studies found this medicinal herb to be more effective in killing *Giardia* than the prescription drugs.



Oregano supplements are also used for external and internal fungal infections. Patients with candidiasis have experienced a remarkable relief from the symptoms after using oregano. Oregano is used for the treatment of flatulence, bloating and other indigestion problems. It enhances the secretion of saliva and serves in improving digestion. It is also effective in overcoming menstrual symptoms and promoting menstruation. Some people use oregano as a natural remedy to treat cold and flu symptoms. Herbal tea prepared with oregano helps in alleviation of headache, urinary problems, lung disorders, diarrhea, nausea, vomiting and jaundice. Oregano boiled in plain water can be used as a mouthwash. Gargling with this water can help to prevent tooth infection and sore throat. Oregano oil applied directly to the infected tooth helps in combating toothache. Ground oregano leaves soothe arthritis pain, insect bites and other skin problems. Its bitter taste and strong aroma help in controlling head lice.

Rosemary

Rosemary is an aromatic, much branched; evergreen shrub to 5 ft. high is a native of the Mediterranean region growing among calcareous rocks on dry, warm slopes in view of the blue sea. The association is evoked wherever leaves emit the resinous scent. Rosemary penetrating aroma requires prudence in amounts added for a savory dish, from a joint of lamb to a mess of fresh, green peas. Apple jelly delicately flavored with a rosemary infusion is a fine accompaniment to poultry or ham. The spectrum in cuisine is wide; wise is the cook who uses restraint. The volatile oil is an ingredient in “*eu de Cologne*”, and high quality comes from flower calyces. Dry leaves and flowers are constituent of potpourri. A wine with added rosemary was taken as a medicina. An infusion in a hair rinse brightens black hair (Wrensch, 1992).



Herst (2001) as cited by Amcay (2009) stated that rosemary leaves have a bitter, astringent taste, which complement a wide variety of foods. The herb can be obtained in whole-leaf form, fresh or dried, as well as in powdered form. A tisane can also be made from them. When burned, they give off a distinct mustard smell, as well as a smell similar to that of burning which can be used to flavor foods while barbecuing. Among dishes where rosemary is used as a seasoning are soaps, vegetables, meats such as lamb, fish and egg dishes, stuffing and dressings, and fruit salads. Rosemary is extremely high in Iron, Calcium, and Vitamin B₆.

BIMR in 2007 said that rosemary contains a number of potentially, biologically active compounds, including antioxidants such as carsonic acid and rosmarinic acid. Other bioactive compounds include caffeic acid, ursolic acid, betulinic acid, rosmaridiphenol, and rosmarol. The results of the study suggest that carnosic acid, found in rosemary, may shield the brain from free radicals, lowering the risk of strokes and neurodegenerative diseases like Alzheimer's and Lou Gehrig's.

It has been stated by Burkhard (1999) that rosemary in culinary or therapeutic doses is generally safe; however, precaution is necessary for those displaying allergic reaction or prone to epileptic seizures. Rosemary essential oil maybe have epileptogenic properties, as a handful of case reports over the past century have linked its use with seizures and otherwise healthy adults or children. Rosemary essential oil is potentially toxic if ingested. Large quantities of rosemary leaves can cause adverse reactions, such as coma, spasm, vomiting, and pulmonary edema (fluid in the lungs) that can be fatal. Avoid consuming large quantities of rosemary if pregnant or breastfeeding.



Rosemary has many uses besides culinary. It is used as a medicinal, an aromatic, and an ornamental in the landscape, as a dye, in cosmetics and as a houseplant. Rosemary essential oil adds a piney scent to soaps, creams, lotions, perfumes and toilet water. It is a stimulating herb and makes a wonderful herbal bath when you feel worn out and want to get your blood flowing under your skin again. Just put some in a muslin bag and get in the tub with it. You can also treat yourself to a cleansing and pick-me-up facial steam with a strong infusion. Blend it in potpourri. It can be woven into wreaths and garlands. Rosemary sachets are very nice for scenting drawers. Dry needles can be added to other herbs and made into closet sachets to repel moths. These smell a lot better than moth balls and are not toxic. It yields a green dye. Medicinally, a warm tea is good for colds, flu, rheumatic pain, indigestion, and as a stimulating drink for headache and fatigue. It is antiseptic and promotes sweating and the flow of bile. It acts as an antidepressant, a circulatory stimulant, and a tonic for the nervous system and the heart. It is a source of Vitamin A and Vitamin C, Phosphorus, Iron, Magnesium, and Zinc. It and has also antioxidant properties. A strong infusion makes an antiseptic mouthwash and gargle. The essential oil can be used externally as an ingredient in salves for arthritis and to soothe aching muscles. Extracts are found in shampoos. A hair rinse of a strong infusion can help dandruff and is good for dark hair. Do not use the pure oil internally. Like all medicinal plants, be cautious when using as a healing herb. In 1995, Brown stated that the essential oil of rosemary should not be used internally and when used externally, it should be diluted as is true for all essential oils except lavender. It should not be used in pregnancy, as it is a uterine stimulant. Large doses are irritating to the kidneys and stomach, but used in lesser amounts as a seasoning, it is perfectly safe.



Culinary use. Bosworth in 2001 stated that rosemary is numerous including the use of its flowers in salads. The herb is a wonderful compliment to meat dishes, especially lamb and pork. It can also be used to flavor baked potatoes, bread and in the herb butter of vegetables. The stems can be used as skewer after removing the leaves. Dried sprigs of rosemary can be tossed on barbecue coals or into wood fires for aromatic grilling. Rosemary being a fragrant herb can efficiently enhance the flavor of any food, be it savory or sweet to which it is added. In general, rosemary can be used in a wide variety of culinary preparations, like for example, to season lamb, rabbit, veal, pork, sausages as well as poultry, egg dishes, fish, pickles and shellfish, rosemary is added to jellies, fruit jams, and cookies. Salad and vegetable dishes that need asparagus, cauliflower, broccoli, eggplants, green beans and peas, zucchini and potatoes, can use rosemary for that extra special flavor. Herb bread and biscuits can derive the benefit of the flavor that rosemary will bring to the dish being prepared. However, one must remember that the flavor can be quite strong, and therefore, the herb must be used only sparingly. They have a bitter, astringent taste, which compliments a wide variety of foods.

Medicinal use. Rosemary is a carminative and stomachic to treat stomach cramps and flatulence, and to stimulate appetite and the secretion of gastric juices. It is considered to be useful against headache and nervous complaints. When used externally (in ointments and bath oils), the oil stimulates blood circulation antibacterial, antifungal, antiparasitic, and mild analgesic activity (it provides some relief from muscle aches and joint pains). Essential oil is present (2.5 %), with 1, 8-cineole, alpha- pinene, and camphor as main components and smaller amounts of beta- pinene, borneol, isobornyl acetate, limonene, linalool, 3- octanane, terpineol and verbinol. Also reported in leaves are phenolic acids



(*Rosmarinus acid*), bitter diterpenes (carnosol, rosmanol), triterpenes (uleanic and ursolic acid), triterpene alcohols (alpha- amyryn, beta- amyryn, betulin), as well as several flavonoids and their glycosides such as diosmetin, luteolin and genkwanin (Wyk and Wink, 2004).

Rosemary is widely used as a spice when cooking, especially in Mediterranean dishes. It is also used for its fragrance in soaps and other cosmetics. Traditionally, rosemary has been used medicinally to improve memory, relieve muscle pain and spasm, stimulate hair growth, and support the circulatory and nervous systems. It is also believed to increase menstrual flow, act as an abortifacient (causing miscarriage), increase urine flow, and treat indigestion. One study in humans found that long term daily intake of rosemary prevents thrombosis. In the lab, rosemary has been shown to have antioxidant properties. Antioxidants can neutralize harmful particles in the body known as free radicals, which damage cell membranes, tamper with DNA, and even cause cell death. Also, rosemary oil appears to have antimicrobial properties (killing some bacteria and fungi in test tubes). It isn't known whether rosemary would have the same effect in humans.

According to Moss (2003) as cited by Amcay (2009), when the smell of rosemary was pumped into cubicles where people were working, those people showed improved memory, though with slower recall.

Embar (2000) as cited by Amcay (2009) mentioned that the nutrient content of 1 serving or 2 tablespoon (3.4g) of fresh rosemary and 1 serving or 1 tablespoon (1.2g) of dried rosemary is as follows:



<u>Minerals</u>	<u>Nutrient value</u>		<u>Vitamins</u>	<u>Nutrient value</u>	
	<u>Dried</u>	<u>Fresh</u>		<u>Dried</u>	<u>Fresh</u>
Ca (mg)	11 (1%)	15 (2%)	Vitamin C (mg)	0.7 (1%)	0.7(1%)
Fe (mg)	0.23 (1%)	0.35 (2%)	Thiamin (mg)	0.001	0.006
Mg (mg)	3 (1%)	3 (1%)	Riboflavin (mg)	0.005	0.005
P (mg)	2	1	Niacin (mg)	0.031	0.012
K (mg)	23 (1%)	11	Pantothenic Acid (mg)	0.027	-
Na (mg)	1	1	Vitamin B6 (mg)	0.001	0.021
Zn (mg)	0.03	0.04	Folate (mcg)	4 (1%)	4(1%)
Cu (mg)	0.010	0.007	Vitamin A (IU)	99(2%)	38(1%)
Mn (mg)	0.033 (2%)	0.022 (1%)			
Se (mcg)	-	0.1			
<u>Macro-nutrients</u>	<u>Nutrient value</u>		<u>Fatty acids</u>	<u>Nutrient value</u>	
	<u>Dried</u>	<u>Fresh</u>		<u>Dried</u>	<u>Fresh</u>
Serving size	2 tbsp (3.4g)	1 tsp (1.2g)	Saturated Fat (g)	0.096	0.088
Calories (kcal)	4	4	Monounsaturated Fat (g)	0.039	0.036
Protein (g)	0.11	0.06	Polyunsaturated Fat (g)	0.031	0.028
Total Fat (g)	0.20	0.18			
Total Carbohydrates (g)	0.70	0.77			
Dietary Fiber (g)	0.5 (2%)	0.5 (2%)			

It has been mentioned by Mayer (1999) that rosemary is one of those herbs that are more potent in the dried than in the fresh state. Dried rosemary is among the most powerful herbal spices, and care must be taken not to overdose which may result in a disagreeable



perfumed odor. In contrast, applying fresh rosemary allows for more of a light hand. Many cooks, especially those influenced by Mediterranean cooking, consider fresh rosemary superior to the dried one in every case, and use fresh rosemary whenever available. Rosemary does not lose its flavor by long cooking, as many other leaves unfortunately do. The fresh leaves have a more pure fragrance and are therefore preferred whenever available. We can also use rosemary for fish, meat (especially poultry), but also for vegetables. It is frequently recommended for potatoes and suitable for vegetables fried in olive oil (aubergines, zucchini, tomatoes), as commonly prepared in Mediterranean countries. In Italian cuisine, mutton is hardly ever cooked without rosemary, and broiled poultry wrapped in rosemary twigs is also very popular. A similar effect can be achieved by sprinkling rosemary leaves on the glowing charcoal during grilling.

According to Falsetto (2009), rosemary is distilled into valuable oil from the steam distillation of the flowers; rosemary has healing properties of being pain relieving, restorative, stimulating, and anti-bacterial, decongestant, diuretic and anti-fungal. Rosemary is used in the treatment of muscular pain, rheumatism, circulation problems, mental fatigue, nervous exhaustion, cellulite, arthritis, colds, bronchitis, fluid retention, and sinusitis is suitable for dry, mature skin and acne.



MATERIALS AND METHODS

Materials

The materials used in the study are shown in Figure 1 and Figure 2. These included 16 kilograms of fresh pork (belly and ham) from the carcass of a single eight months old pig. The other ingredients used in the making of “*etag*” were the following: rock salt, powdered basil, powdered oregano, and powdered rosemary. Other materials like knives, drinking straw, digital weighing scale, chopping board, basin, pen, record book, and alnus leaves fire woods (fresh and dried) were also used in the study.

Methodology

Experimental design and treatments. Following the Completely Randomized Design (CRD), the meat was equally divided into four treatments. Each treatment had four replications with one kilogram of pork per replication.

The different treatments were as follows:

T₀= 150 g rock salt (control) per kg meat

T₁= 150 g rock salt + 30 g powdered basil per kg meat

T₂= 150 g rock salt + 30 g powdered oregano per kg meat

T₃= 150 g rock salt + 30 g powdered rosemary per kg meat

To produce the “*etag*”, only one procedure was followed in all the treatments. The only difference was on the type of herb used per treatment.





Figure 1. Some materials used in the study

Curing of meat. A total of 16 kg of fresh pork shown in Figure 2 from a single pig were sliced into 1-inch thick strips containing the skin, fat and lean. After slicing, the pork strips were placed in Ziploc bags for curing. The herbs used for curing (basil, oregano and rosemary) were bought in commercial powdered form. The meat strips were cured with rock salt, basil, oregano and rosemary following the amounts indicated under each treatment. These herbs were mixed with the salt then rubbed thoroughly on all sides of the meat strips. After rubbing, the meat strips were piled evenly in clean Ziploc bags, sealed then stored in the dark at room temperature for seven days.

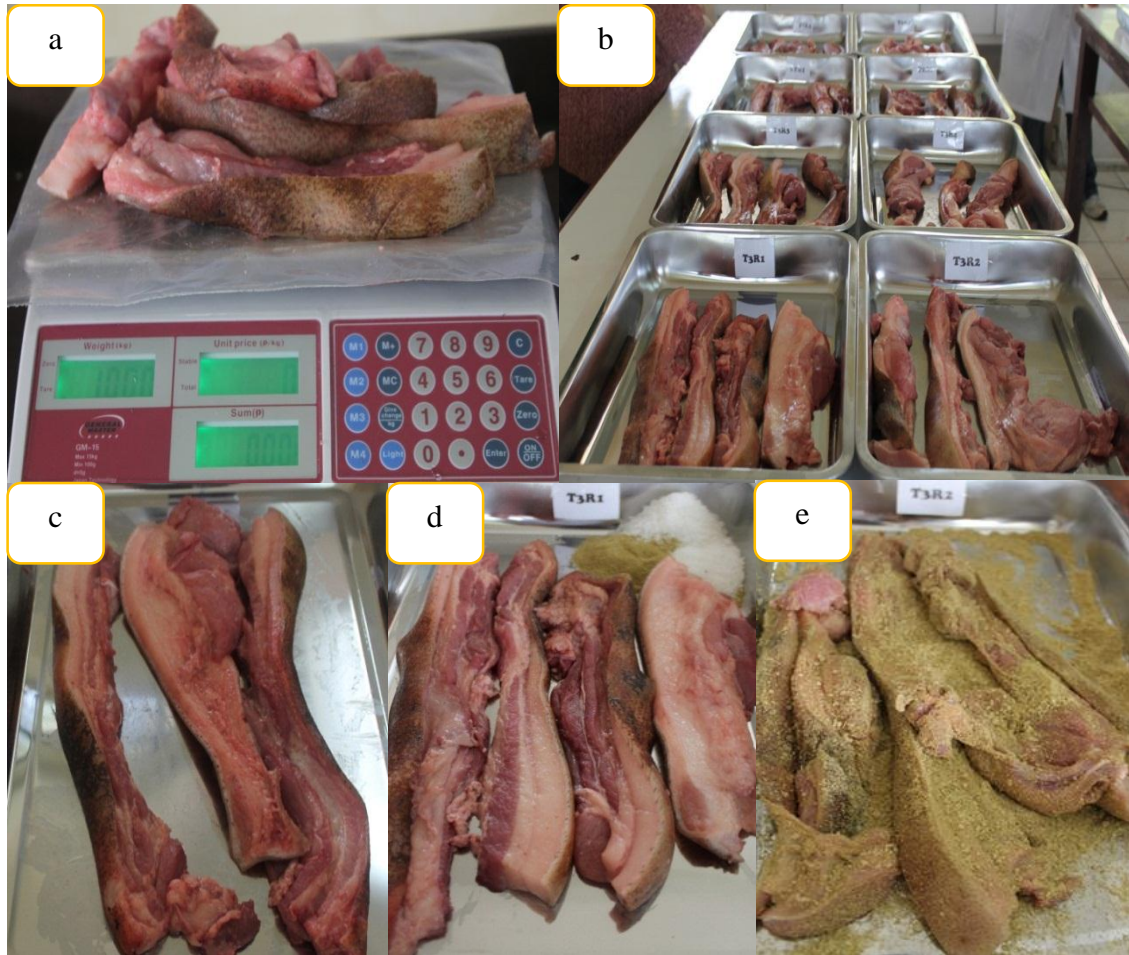


Figure 2. Meat strips weighed in a digital weighing scale (a) and placed in stainless pans for curing (b, c, d, e).

Hot smoking. Each meat strip was weighed and labeled for identification. The meat strips were stringed by making a small cut with a narrow bladed knife, then inserting a clean drinking straw into the cut; these were hanged in the smoking chamber. The hangers were arranged in such a way that it prevent the pork strips from coming in contact with each other, to ensure uniform penetration of smoke, and to guarantee the meat strips have equal color development. The meat strips were suspended above the safety baffle in the smoker which is shown in Figure 3.



Figure 3. Meat strips hanged after 7 days curing (a) inside the smoking chamber (b).

To produce the smoke, pieces of air-dried alnus firewood (about 1 kg) and air-dried alnus leaves (about 1 kg) were lighted inside the fire pit. When the wood was lighted and the fire emitted was stable, fresh alnus firewood and leaves were placed over the fire to produce smoke. Initially, $\frac{1}{2}$ of fresh alnus firewood and leaves were spread over the burning wood to produce the smoke and then $\frac{1}{2}$ kg was added every 20 minutes until the end of the smoking duration. Slow fire was maintained and smoking was done continuously for 24 hours. After smoking, the meat strips were placed in stainless pans for weighing (shown in Figure 4) then placed in clean Ziploc bags and stored at room temperature for 2 weeks to age shown in Figure 5.

Eighteen kilograms of firewood and 18 kilograms of leaves were used per treatment, for a total of 72 kilograms of wood and 72 kilograms of leaves.



Figure 4. Smoked meat placed in stainless pans for weighing, salt only (a), basil (b), oregano (c), and rosemary (d)



Figure 5. Smoked meat placed in clean Ziploc bags (a) and placed in a clean carton for 2 weeks storage (b).



Sanitation and hygiene. To prevent or minimize microbial contamination, the following good hygiene practices (DOH, 2004) in meat processing and handling of smoked products were observed: (1) Adequate personal cleanliness was maintained; (2) Adequate garments, and hand gloves were worn; (3) Hands were washed before starting work and repeatedly during work; (4) No rings, watches and bracelets were worn during work; (5) Tools, knives, chopping boards, utensils, and other materials for meat handling were cleaned and disinfected; (6) Any necessary precautions to protect against contamination of meat and finished product were taken.

Organoleptic testing. After two weeks of storage, samples from the “*etag*” produced in each treatment was steamed for 30 minutes, sliced into bite sizes then offered to a taste panel for organoleptic testing. Twenty persons who are consuming “*etag*” served as members of the taste panel. This test was conducted four times to compose four replicates per treatment and was held at the Department of Animal Science (Meat Laboratory), College of Agriculture, Benguet State University Figure 6.



Figure 6. The organoleptic test

During the organoleptic test, each panel member was given a score card for her/him to indicate her/his ratings. Each panel member was requested to drink water after each taste to every sample to wash off any remains of the “*etag*” sample previously tasted that might affect her/ his rating on the next “*etag*” sample.

Data Gathered

1. Appearance of the product. The panel evaluated each sample as: (1) Desirable, (2) Moderately desirable, (3) Slightly desirable, (4) Slightly undesirable, (5) Undesirable.

2. Aroma of the product. The panel evaluated each sample as: (1) Desirable, (2) Moderately desirable, (3) Slightly desirable, (4) Slightly undesirable, (5) Undesirable.

3. Flavor of the product. The panel evaluated each sample as: (1) Very good, (2) Good, (3) Fair, (4) Poor, (5) Very poor.

4. Taste of the product. This was evaluated by the panel of tasters as: (1) Very good, (2) Good, (3) Fair, (4) Poor, (5) Very poor.

5. Tenderness of the product. The panel evaluated each sample as: (1) Extremely tender, (2) Very tender, (3) Moderately tender, (4) Slightly tender, (5) Tough.

6. Acceptability of the product. The panel evaluated each sample as: (1) Like very much, (2) Like moderately, (3) Dislike, (4) Dislike moderately, (5) Dislike very much.

7. Weight of “*etag*” before drying (kg). This was the weight of the salted meat before it was subjected to smoking and after 7 days curing.

8. Weight of “*etag*” after drying (kg). This was the weight of the “*etag*” that was dried over a smoke.

9. Volume of wood used (kg). This refers to the amount of wood that was used in drying the “*etag*”.



Data Computed

1. Total cost of production (PhP). This was computed by adding all the cost of meat and other materials used in producing the “*etag*” per treatment.

2. Shrinkage percentage. This was obtained by dividing the difference of the weights of “*etag*”, before and after smoking, by the weight of the “*etag*” before drying multiplied by 100.

Statistical Analysis

The data gathered were recorded, tabulated, and analyzed for their differences using the Analysis of Variance (ANOVA) for the Completely Randomized Design (CRD). The Duncan’s Multiple Range Test (DMRT) was used to determine significant differences between treatment means.



RESULTS AND DISCUSSION

Table 1 shows the mean appearance of the product produced in the different treatments as rated by the panel of tasters. It also reveals the corresponding verbal rating of the treatment numerical means.

Based on the verbal rating, meat which was cured with rock salt, rock salt + oregano, rock salt + rosemary were all rated moderately desirable whereas meat with rock salt + basil was rated slightly desirable. Considering the numerical ratings in all treatments, it can be gleaned that the rock salt + oregano-cured meat was the most desirable in appearance while the meat cured with rock salt + basil was least desirable among the four products. In comparison, plain rock salt and rock salt + oregano produced equally appealing products. Furthermore, the appearance of meat cured with rock salt + rosemary and that which was cured with rock salt + basil was also more or less similar.

Table 2 demonstrates the aroma of the products as rated by the panel of tasters. Although statistical analysis found significant differences among treatment means, the verbal description for all treatments was moderately desirable. From a numerical standpoint, it can be implied that the panel may have found the odor of oregano and basil more pleasant than rosemary. This implication can be validated by Mayer (1999) stating that care must be observed in using rosemary as an overdose may result to a disagreeable perfumed odor. On the overall, the aroma of meat cured with plain rock salt, rock salt + oregano and rock salt + basil were similarly more preferred by the tasters than the aroma of meat cured with rock salt + rosemary.

According to Donoso (2007) the best way to cure is by smoking the salted meat by a preferred wood with some herbal leaves for aroma and flavor.



Table 1. Appearance of the product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.05 ^{ab}	Moderately desirable
Rock salt + Basil	2.61 ^c	Slightly desirable
Rock salt + Oregano	1.98 ^a	Moderately desirable
Rock salt + Rosemary	2.41 ^{bc}	Moderately desirable

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

Table 2. Aroma of the product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.14 ^{ab}	Moderately desirable
Rock salt + Basil	2.12 ^{ab}	Moderately desirable
Rock salt + Oregano	1.99 ^a	Moderately desirable
Rock salt + Rosemary	2.39 ^b	Moderately desirable

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

The ratings for the flavor of the product are illustrated in Table 3. Statistical analysis showed highly significant differences among treatments. Following the trend on aroma, the panel of tasters rated the flavor of meat cured with plain rock salt, rock salt + Basil and rock salt + oregano as good while they find the flavor of the meat cured with rock salt + rosemary to be fair.



The herbs used in the study are traditionally used as flavoring agents and hence they were able to enhance the flavor of the meat except for rosemary which produced a flavor comparable to pine-tar. This was not very acceptable to the panel of tasters resulting to the rating of fair.

The green aromatic leaves of basil are used fresh and dried as flavorings or spices in sauces, stews, salad dressings, vegetables, poultry, vinegar, and confectionery products (Simon, 1995), and it was also mentioned by Wrench (1992) that dried basil leaves are used in a preparation of salt and spice- free dietetic meat products. Moreover, according to Katser (2007) oregano flavors grilled meats; it is used for the vertical rotating spit roast meat *gyros*. The very similar, but stronger, taste of Mexican oregano is popular not only in its native country México, but also in the south of the US, where it is frequently used to flavour *chili con carne* (meat stewed with chiles and sometimes beans) or other México-inspired dishes.

Table 3. Flavor of the product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.38 ^a	Good
Rock salt + Basil	2.31 ^a	Good
Rock salt + Oregano	2.08 ^a	Good
Rock salt + Rosemary	2.71 ^b	Fair

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT



Table 4 represents the taste of the product. Statistical analysis showed highly significant differences among treatment means. The taste of meat cured with plain rock salt, rock salt + basil cured meat, and rock salt + oregano cured meat are comparable and better than rock salt + rosemary-cured meat. It was then observed that rock salt + rosemary cured meat had the least desired taste of all the products. This may be explained by Bosworth's statement (2001) that the taste and flavor of rosemary has a bitter, astringent taste and can be quite strong, and therefore, the herb must be used only sparingly.

Table 5 illustrates the tenderness of the product. Verbal rating of the product shows that all treatments garnered a rating of moderately tender. Tenderness of meat cured with rock salt only, rock salt + basil, rock salt + oregano, and rock salt + rosemary is constant because the pork came from the same pig.

Table 4. Taste of the product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.26 ^a	Good
Rock salt + Basil	2.28 ^a	Good
Rock salt + Oregano	2.13 ^a	Good
Rock salt + Rosemary	2.94 ^b	Fair

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT



The ratings for the overall acceptability were presented in Table 6. Comparison of numerical means reveal that rock salt + oregano-cured meat accounts appears most acceptable similarly with the meat cured with plain rock salt and rock salt + basil. These three treatments had significantly better means based on the hedonic scale than the rock salt + rosemary treatment. Despite differences in numerical means, it can be noted that all products from the four treatments were liked moderately. Figure7 shows the graphical summary of the result of sensory traits evaluation.

Table 5. Tenderness of the Product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.86 ^a	Moderately tender
Rock salt + Basil	2.74 ^a	Moderately tender
Rock salt + Oregano	2.51 ^a	Moderately tender
Rock salt + Rosemary	2.78 ^a	Moderately tender

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

Table 6. Acceptability of the Product

TREATMENT	NUMERICAL MEAN	VERBAL RATING
Rock salt only	2.00 ^a	Like moderately
Rock salt + Basil	1.99 ^a	Like moderately
Rock salt + Oregano	1.88 ^a	Like moderately
Rock salt + Rosemary	2.45 ^b	Like moderately

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT



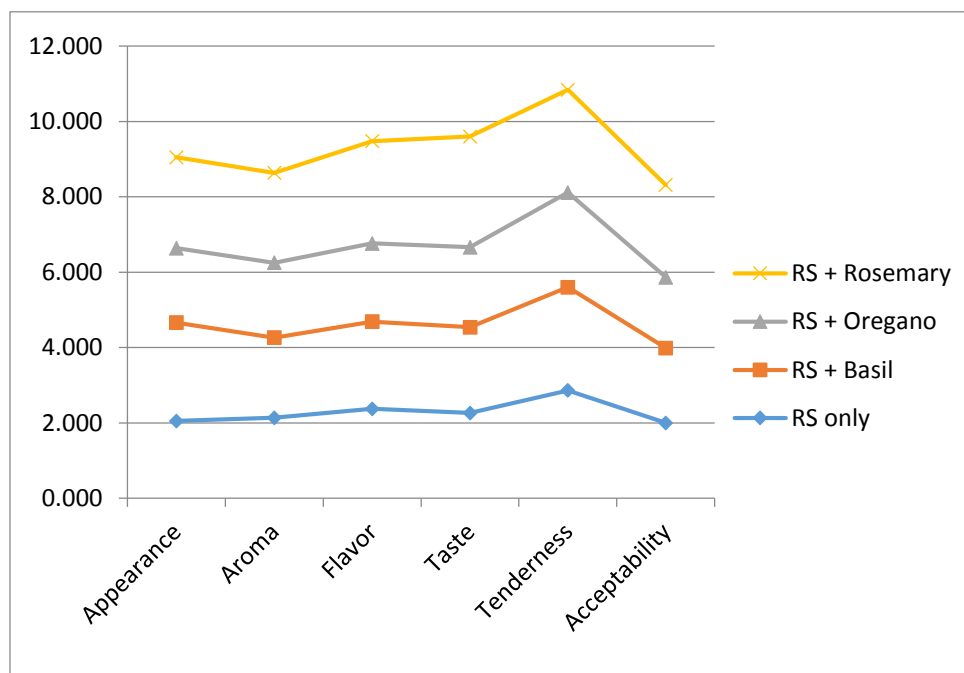


Figure7. Graphical summary of the result of sensory traits evaluation

The shrinkage of the different products is presented in Table 7. Salting and smoking are factors responsible for water loss. Aside from helping reduce water, smoking also helps in the curing process. Oregano-cured meat had the lowest shrinkage of 22.50% while the meat cured with plain salt and salt +basil had 23.13% and 23.25% shrinkage, respectively. Rosemary-cured meat was observed to have the highest shrinkage loss which is 24.38%. There were no appreciable differences in the shrinkage largely due to the fact that the meat came from the same cuts in the animal carcass (belly and ham) and that the salt and smoking time were kept constant across all treatments.

Table 8 shows the production cost for four kilograms of “*etag*” in each treatment. It is shown in the table that the Oregano-cured meat had the highest cost of PhP 1,853.68 and was followed by the Rosemary-cured meat with a cost of PhP 1,852.60. It was then followed by the basil-cured meat which is PhP 1,852.06. The meat cured with plain salt



had the lowest cost which is PhP 1,824.52. The difference in the cost is due to the price differences of flavoring agents used.

Table 7. Shrinkage of the product

TREATMENT	SHRINKAGE (%)
Rock salt only	23.13 ^a
Rock salt + Basil	23.25 ^a
Rock salt + Oregano	22.50 ^a
Rock salt + Rosemary	24.38 ^a

Means with the same superscript are not significantly different ($P \geq 0.05$) DMRT

Table 8. Total cost of production

ITEM	T₀	T₁	T₂	T₃
EXPENSES (PhP)				
Pork	640.00	640.00	640.00	640.00
Salt	9.00	9.00	9.00	9.00
Powdered basil	-	27.54	-	-
Powdered oregano	-	-	29.16	-
Powdered rosemary	-	-	-	28.08
Fire woods and leaves	92.50	92.50	92.50	92.50
Drinking straw	0.40	0.40	0.40	0.40
Ziploc bags	10.12	10.12	10.12	10.12
Labor	1,072.50	1,072.50	1,072.50	1,072.50
TOTAL COST OF PRODUCTION	1,824.52	1,852.06	1,853.68	1,852.60



SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

The study was conducted to determine which herb is the best flavoring agent in making “*etag*”. It also aimed to evaluate the product in terms of appearance, flavor, aroma, taste, tenderness, and over all acceptability of the product.

The study was conducted at the Meat Processing Laboratory, Department of Animal Science, Benguet State University, La Trinidad, Benguet from October to November 2012. Following the Completely Randomized Design (CRD), 8 kilograms of belly and 8 kilograms of ham taken from a newly butchered eight months old pig was equally divided into four parts to represent the four treatments. Each treatment has four replications with one kilogram of pork per replication. Meat assigned to the control (T_0) treatment was salted with 150 g rock salt, 150 g salt + 30 g basil for T_1 , 150 g salt + 30 g oregano for T_2 , and 150 g salt + 30 g rosemary for T_3 .

A total of 20 “*etag*” consumers were invited to evaluate the product. Data gathered from the evaluation were analyzed using the analysis of variance for Completely Randomized Design (CRD). Means were compared using the Duncan’s Multiple Range Test (DMRT).

It was found that “*etag*” cured with plain rock salt, rock salt with basil and rock salt with oregano were better in appearance, aroma, flavor, taste, and overall acceptability compared to “*etag*” cured with rock salt plus rosemary.

In terms of shrinkage, the products were more or less similar. On the other hand, differences in the production cost per treatment were observed as a result of the price differences of the herbs used.



Conclusion

Based on the result of the study, it is therefore concluded that herbs like basil and oregano could be used to enhance the flavor of “*etag*”. It was seen that the addition of these herbs in the curing mix produced products which are similar in sensory traits as that which was cured with plain rock salt.

Recommendation

It is therefore recommended that flavoring agents like oregano and basil can be used as flavoring agents for “*etag*”. However, it is also recommended that “*etag*” producers may try to vary the amount of herbs to be added to salt to produce the most desired results.



LITERATURE CITED

- AMCAY, J. 2009. Evaluation of Embutido Processed with Dried Rosemary (*Rosmarinus officinalis*) Leaves. Undergraduate Thesis. Benguet State University, La Trinidad, Benguet. Pp. 6, 8, and 10.
- AMRIK, B. and G. BILKEI. 2002. Influence of Farm Application of Oregano on Performance of Sows. Canadian Veterinary Medical Association. Bilkei Consulting, Raubbuhlstrasse 4, CH-8600 Dubendorf, Switzerland. Pp. 89-90.
- BAGGEO, E. 2011. Effect of Oregano Juice on the Growth Performance of Cobb Broilers during the Brooding Stage. Undergraduate thesis. Benguet State University, La Trinidad, Benguet. P. 3.
- BOSWORTH, S. 2001. Rosemary. Retrieved July 10, 2012 from http://spec.lib.vt.edu/CulinaryThymes/2001_02/02Rosemary.html
- BROWN D. 1995. Encyclopedia of Herbs and their Uses. Dorling Kindersely, London. P. 21.
- BURKHARD, P. R. 1999. "Plant-induced seizures: reappearance of an old problem". *Journal of Neurology* 246 (8): 667-670. doi:10.1007/s004150050429.PMID 10460442.
- BURNHAM INSTITUTE FOR MEDICAL RESEARCH (BIMR). 2007. Rosemary chicken protects your brain from free radicals. Retrieved July 10, 2012 from <http://www.sciencedaily.com/releases/2007/10/0710302210.htm>
- Da CUNHA, R. 2007. The art of flavoring meat. Meat International. Volume 17. Number 10. P 16.
- DEPARTMENT OF HEALTH. 2004. Administrative Order No. 153, S, 2004, Revised Guidelines on Current Good Manufacturing practice in Manufacturing, Packing, Repacking, or Handling Food. Retrieved July 12, 2012 from [http:// www. Bfad.gov.ph /pd/RegulatoryGuidance/food/ao/A0153s2004.pdf](http://www.Bfad.gov.ph/pd/RegulatoryGuidance/food/ao/A0153s2004.pdf)
- DONOSO, J. 2007. The art of flavoring meat. Meat International. Volume 17. Number 10. P 17.
- FALSETTO, S. 2009. "The Medicinal Herb Rosemary: A Plant Profile of Rosemary and its Healing Properties". Retrieved July 12, 2012 from http://medicinalplants.suite101.com/article.cfm/the_medicinal_herb_rosemary#ixz0000000Kr



- HOLMES, C. 2004. *A Zest for Herbs: Choosing, Using and Designing with Garden Herbs*. Published by Mitchell Beazley, an imprint of Octopus Publishing Group Ltd. 2-4 Heron Quays, London. P. 146.
- KATSER, G. 2007. *Oregano (Origanum vulgare L.)*. Retrieved September 6, 2012 from http://www.uni-graz.at/~katzer/engl/Orig_vul.html
- LEUNG, A. 1996. *Encyclopedia of Common Natural Ingredients*. 2nd Edition. New York. John Wiley and Sons. Pp. 398-399.
- MAYER, M. 1999. AGELESS: the trusted herbal anti-aging site. Retrieved July 10, 2012 from <http://www.ageless.co.za/rosemary4.htm>
- McHOY, P. 2001. *The Gardener's Handbook: The practical guide to planning, planting, and maintaining your garden*. Published in United State of America by Hermes House, Anness Publishing Inc. 27 West 20th Street, New York, NY 1001. P. 183.
- POGEYED, M. 2009. *Evaluation of Embutido Processed with Basil (Ocimum basilicum)*. Undergraduate thesis. Benguet State University, La Trinidad, Benguet. Pp. 5-6.
- SANDHYARANI, N. 2011. BUZZLE: Medicinal Uses of Oregano. Retrieved September 6, 2012 from <http://www.buzzle.com/articles/medicinal-uses-of-oregano.html>.
- SARDI , B. 2001. *Oil of Oregano Rivals Modern Antibiotic Drugs*. Word of Knowledge Agency, San Dimas, California. P 34.
- SIMON, J. 1995. Basil. Retrieved July 12, 2012 from <http://www.hort.purdue.edu/newcrop/cropfactsheets/basil.html>
- SIMON, J. E., J. QUINN, and R. G. MURRAY. 1990. Basil: A source of essential oils. In: J. Janick and J.E. Simon (eds.), *Advances in new crops*. Timber Press, Portland, OR. Pp. 484-489.
- SYMEON, G. 2000. Effects of Oregano Essential Oil Dietary Supplementation on the Feeding and Drinking Behaviour as well as the Activity of Broilers. Department of Animal Production, Laboratory of Animal Breeding and Husbandry, Agricultural University of Athens, 75 Iera Odos, GR 118 55 Athens, Greece. P. 55.
- WRENSCH, R. 1992. *The Essence of Herbs, an Environmental Guide to Herb Gardening*. University Press of Mississippi, United States of America. Pp. 190-191, 247-248.
- WYK, B. and M. WINK. 2004. *Medicinal Plants of the World*. Briza Publications, South Africa. Pp. 221, 217, 276.

