# BIBLIOGRAPHY

SELGA, JESSIE G. APRIL 2013. Sensory Evaluation of Grilled Whole Rabbit Stuffed with Leaves of Lemon grass or Pandan. Benguet State University, La Trinidad, Benguet.

Adviser: Sonwright B. Maddul. PhD.

## ABSTRACT

The study was conducted at the Department of Animal Science Meat Laboratory, College of Agriculture, Benguet State University, La Trinidad, Benguet to determine the preference for whole grilled rabbit carcass stuffed with leaves of lemon grass or *pandan* and to be able to determine the cost of producing the finished product.

Finished products were brought to a consumer panel preference and acceptability test. The sensory panel were composed of 10 people who have consumed the product and 10 who have not consumed the product.

Result exposed that there were no significant differences among treatments on appearance, taste, tenderness and acceptability but are significantly different in aroma. Grilled rabbit stuffed with lemon grass was better in aroma than the grilled rabbit stuffed with *pandan* and no stuffing.

Furthermore, the grilled rabbit stuffed with lemon grass and *pandan* were numerically rated to be more tender, appealing in appearance than grilled rabbit without stuffing. For acceptability of grilled rabbit stuffed with lemon grass, it was more acceptable than grilled rabbit stuffed with *pandan* and grilled rabbit with no stuffing.

# INTRODUCTION

There is a great opportunity for rabbit farming in the Philippines. Rabbits require small space and less food for survival. They grow very fast and the female rabbit produces seven to eight young per litter after 31-32 days of gestation. They eat low quality food and convert this into high quality meat. Raising rabbit can be a great source of income to the unemployed people and landless farmers. Thus, rabbits should be raised to meet the demand for protein as well as to reduce poverty among our society. To satisfy the food demand of our ever-growing populations, we have to find out different ways of food production.

Rabbits can be a great source of food since almost all the body parts of the animal are useful for human consumption. Rabbit meat contains high ratio of protein, energy, calcium and vitamins than other species of animal. The cholesterol content of meat from rabbits was reported by Lukefahr *et al.*(1989) to be lower than common red meats and poultry. The meat of rabbit is very tasty, easily consumed and all religious people can eat it. Rabbit meat compares very favorably to chicken, turkey and some fish for its beneficial health virtues and its palatability.

Furthermore, rabbit meat is primarily a white meat that is very fine in texture and has very low fiber content. Thus, rabbit meat is easily digested which is desirable for individuals who may have difficulty in chewing their food (Warren, 1995).

In Europe, rabbit meat is still considered a niche product, especially because of its time consuming preparation which requires culinary skills and because of cultural differences among consumers. However, rabbit meat is often recommended by nutritionists over other meats because it fits well with the current consumer demand for a low-fat meat

with a high degree of fatty acid unsaturation and low sodium and cholesterol levels. Moreover, consumer lifestyle changes in developed countries have led to a meat market more focused on easy-handled and processed products called "convenience foods" (Petracci *et al.,* 2009).

Hence, rabbits are raised world-wide for many reasons, including the several dishes and different menu using rabbit meat. One authentic menu that would fit to the taste of individuals, especially by Filipinos is the stuffed grilled rabbit. This cuisine out of a whole rabbit carcass provides not only delicious food product but one of the nutritious food items available. The shortage of meat and the need to develop new recipes for the discriminating taste of the consumers gives rise to a challenge in developing cheap, nutritious and tasty food out of other meat sources like rabbit at a very affordable price. Fresh or frozen, rabbit meat is sold all year round. It can be used in most of the ways in which chicken is used. Like other lean meats, poultry, and fish, rabbit meat is a good source of high quality protein. The meat is fine grained and mild flavored. Fryer or young rabbit—the terms "fryer" or "young rabbit" refer to a rabbit weighing not less than 1 ½ pounds and rarely more than 3 ½ pounds, and less than 12 weeks of age. The flesh is tender, fine grained, and a bright pearly pink color. These rabbits may be cooked in much the same way as young poultry. A whole, 2 to 2 1/2-pound rabbit should take about 1 to 1 1/2 hours to roast. Stuffing it will add approximately 1/2 hour to the cooking time.

Many restaurants now offer several dishes that are prepared using rabbit meat. According to a report by the USDA (1979), rabbit meat ranks highest in protein and lowest in fat content and calories compared to beef, chicken, lamb and pork. It is not only high in protein and low in fat and cholesterol but it is also easily digested and very flavorful.

One way of enhancing the taste of meat is by using herbs and spices. There are many natural stuffing which will enhance and adds desirable flavor and aroma to the meat. The key is the use of stuffing like leaves of lemon grass and *pandan*, together with other ingredients that can fit to the specific taste of individual.

This study would make way for the innovative cooking and improving of another savory dish out of a whole rabbit carcass. It may also serve as a reference for anyone who is interested in the preparation of grilled rabbit stuffed with different herbs and spices and come up with a mouth-watery food product.

This study was conducted to determine consumer perception on sensory properties of whole grilled rabbit meat stuffed with leaves of lemon grass or *pandan* and to be able to estimate the cost of producing the food product. This study was carried out at the Meat Laboratory of Benguet State University in the month of February 2013.

# REVIEW OF LITERATURE

Limited studies on cholesterol content of rabbit meat have been reported. According to Lukefahr *et al.,* (1989), cholesterol content of uncooked rabbit meat (total ground lean tissue) was $163.6 \pm 3.1$mg/100g DM. Recently, the nutritional value of rabbit meat has been reviewed by several authors showing that rabbit meat has a high nutritional value compared with other meats.

The main components of meat, excluding water, are proteins and lipids. Rabbit meat is a lean meat rich in proteins of a high biological value and it is characterized by high levels of essential amino acids (Dalle Zotte, 2004). Furthermore, meat is also an important source of highly available micronutrients, such as vitamins and minerals. Also, rabbit meat does not contain uric acid and has a low content of purines (Hernández, 2007). The information available on chemical composition of rabbit meat is extremely variable, especially regarding fat content, depending on the part of the carcass studied (Pla *et al.*, 1998) and also on the different productive factors (Dalle Zotte, 2002), especially feeding factors having a strong influence on the chemical composition of rabbit meat, in particular, on its lipid composition.

Rabbit meat is characterized by its lower energetic value compared with red meats due to its low fat content (Dalle Zotte, 2004). Fat content varies widely depending of the carcass portion from 0.6 to14.4% (fat from edible meat with intramuscular and intermuscular fat content) with an average value of 6.8% (Hernández and Gondret, 2006) with the loin being the leanest part of the carcass (1.2% of lipids). Fatty acid composition of rabbit meat is characterized by high polyunsaturated fatty acid content.

The amount of cholesterol in rabbit meat is about 59 mg/100 g of muscle (Combes,2004), lower values than those presented in meat from other species (61 mg in pork, 70 mg in beef, 81mg in chicken) (Dalle Zotte, 2004).

Rabbit meat taste like chicken and does not carry the stigma of rodents. It has more proteins and less fats and calories per gram than beef, pork and lamb. Interest in rabbit continues and is now widely recognized that raising of the animals in developing countries has great potential as a means of improving economic security. When rabbits are reared according to the technique appropriate to the environment they can do so much to improve the family diet of the most needed rural families at the same time supplying them with a source of income (Vietmeyer, 1991).

Animals have most likely been stuffed since man or his ancestors began cooking food. After cleaning out the body cavity of internal organs, you have a hollow space that just begs to be filled. Especially for birds, rabbits, hare, suckling pigs, etc. They have a small cavity, and the stuffed animal could be cooked through in a reasonable amount of time (Ehler, 2012).

Lemongrass (*Cymboporon citratus*) i**s** a fragrant grass that grows in abundant clumps just about anywhere in the tropic**.** It possesses a larger bulb near the base of the stalks and it is here that the lemon or citrus flavoring is most often obtained (though we Filipinos use the entire leaf for stuffing).Common names include lemon grass, lemongrass, barbed wire grass, silky heads, citronella grass,cha de Dartigalongue, fever grass, tanglad, hierba Luisa or gavatichaha amongst many others. Lemongrass is native to India and tropical Asia. It is widely used as a herb in Asian cuisine. It has a subtle citrus flavor and can be dried and powdered, or used fresh (Shadab *et al*., 1992).

Epicurious (2012) stated that lemon grass for stuffing is famous throughout of Southeast-Asia. A dish with lemon grass recipe is particularly fragrant and moist, imbued with theflavors of both lemon and lime and also lends a delicate flavor to the simple roasted dish.

Pandan (*Pandanus amaryllifolius*) is a type of plant that grows in tropical areas of Asia. *Pandan* leaves have a sweet, unique flavor that is commonly used in Southeast-Asian countries to enhance both desserts and savory dishes. The leaves are long and bright green, and when pounded or ground, they lend a sweet taste and aroma to many Thai desserts and some drinks (Thaifood, 2012).

TheLittleTeochew (2010) mentioned that *pandan* leaves sudden releases off intense, intoxicating smell, sweet-scented, swirling, spirally and steaming aroma to the roasted dish.

Grilling is a form of cooking that involves dry heat applied to the surface of food, commonly from above or below. Grilling usually involves a significant amount of direct, radiant heat, and tends to be used for cooking meat quickly and meat that has already been sliced (or other pieces). Grilling is often presented as a healthy alternative to cooking with oil, although the fat and juices lost by grilling can contribute to drier food. Grilled foods can be lower in saturated fat, if fat is allowed to drip out after it liquefies (Riccio, 2006).

# MATERIALS AND METHODS

Materials

       The materials used in the experiment include nine whole rabbit carcasses used in the preparation of the grilled menu. They were obtained from 10-week-old rabbit fryers of the New Zealand White breed; leaves of herbs such as lemon grass leaves (*Cymbopogon citrates*) and *pandan* leaves (*Pandanus amaryllifolius*) for stuffing (Figure 1); soy sauce, refined sugar, ground black pepper, garlic, onion, cooking oil, and butter for seasoning.

Treatments

       A total of nine whole rabbit carcasses were used to conduct the experiment involving the following treatments:

     $T_0$ = No herb stuffing

     $T_1$ = Lemon grass stuffing

     $T_2$ = *Pandan* stuffing

       For every one whole rabbit carcass, the following stuffing and seasoning materials were used: 50g each of lemon grass leaves or *pandan* leaves as  stuffing materials, 1tbsp black pepper, 3 cloves garlic, 1 pc onion sliced, 2tbsp melted butter,  1 tbs. sugar, 4tbsp soy sauce, and 2tbsp cooking oil.

       Rabbits were slaughtered after a 12-hour fasting following the standard procedure for slaughtering rabbits. The slaughtering procedure includes stunning, hoisting, sticking, bleeding, skinning, and evisceration. The rabbit carcasses were not rendered for fabrication since whole carcasses were needed for the experiment.
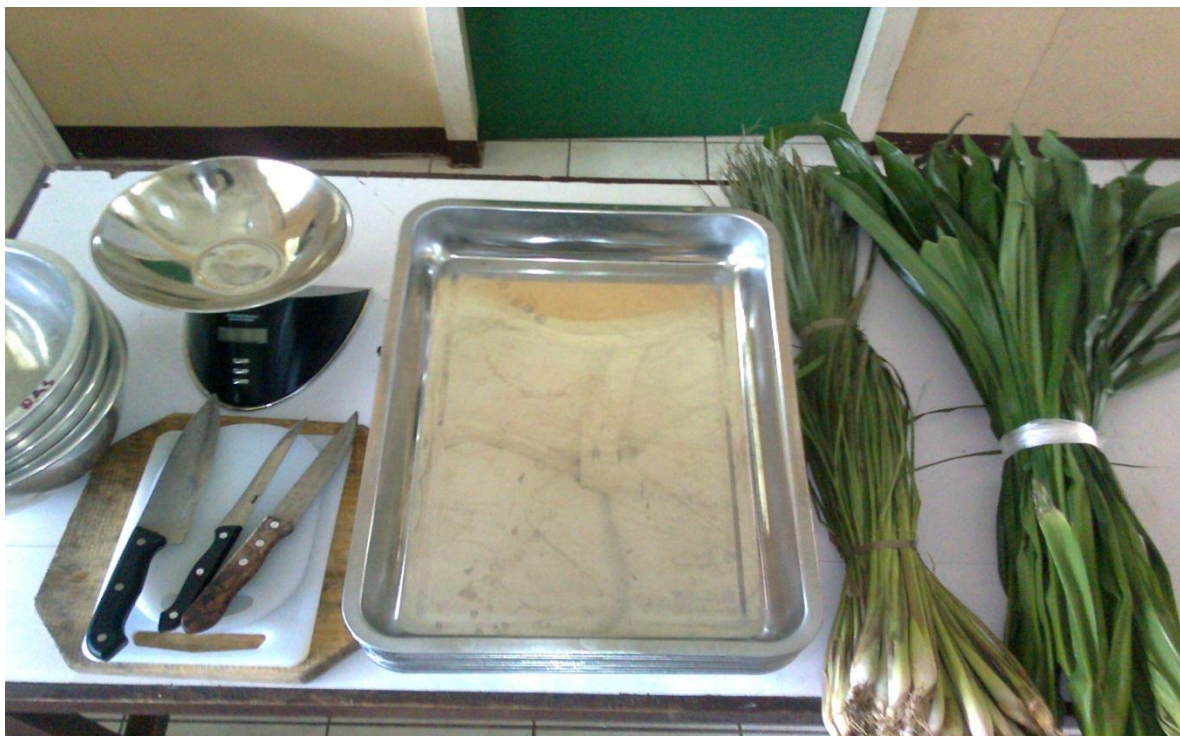
Figure 1. Lemon grass, *pandan* leaves and other materials used

Preparation of Marinade and Stuffing

Only good quality raw materials were used. About 100g of fresh leaves of lemon grass or *pandan* were crushed separately using a mortar and mixed with the other ingredients to make up the marinades (M1 and M2) for treatments 1 and 2, respectively. The marinade for the control treatment (M0) consists of the seasoning materials only. All rabbit carcasses were marinated overnight in three large containers for the separate treatments. About 50g of either leaves were cut into 15-cm lengths. These were used to stuff each rabbit carcass in treatments 1 and 2.

Grilling

A whole rabbit carcass was impaled with a skewer and placed in a coal-fired grill at low heat. Before grilling and every 15 minutes of grilling, the carcass was brushed with

the marinade together with melted butter. The carcass was removed from the grill after 40-45 minutes or when temperature inside the carcass has reached 160º F.



Figure 2. The rabbit carcasses upon grilling

Sensory Evaluation

A whole grilled rabbit carcass was coded and presented to the panel of tasters for evaluation of the appearance. And for the ratings of taste, texture/tenderness, aroma and acceptance of the meat, each coded sample was sliced and subjected to preference test by untrained panelists. The panel were composed of 10 people who have consumed rabbit meat and 10 people who have not consumed rabbit meat before. It was made sure that each panellist are free from the following defects: taste perception disorders, odor perception disorders, color blindness, denture defects, allergies, and minor infections of nose and throat. In addition, they were not currently using those medications that affect the ability to taste and smell.

A score card was given to each member of the panel to write down their respective rating for each product by simply ticking a box to indicate their preference. Drinking water was made available to the panel to cleanse their palette after tasting each food sample.

The tasters were also asked to make remarks about the product's appearance, taste, aroma and texture. The total cost of food product was computed by adding all the costs of meat and ingredients used per treatment.



Figure 3. Panelists having the sensory evaluation

The appearance, taste, texture, aroma and overall acceptability of the product were evaluated using a 5-point Hedonic scale below:

| Numerical Rating | Adjectival Rating |
|---|---|
| 1 | Dislike very much |
| 2 | Dislike |
| 3 | Neither like or dislike |
| 4 | Like |
| 5 | Like very much |

Data Analysis

Data were recorded, tabulated and analysed using Analysis of Variance for Directional Paired Comparison Test. Treatment means were compared using the Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Appearance

Table 1 shows the rating on appearance of grilled rabbit stuffed with different stuffing. Statistical analysis shows no significant difference among treatments. It implies that lemon grass and *pandan* stuffing did not affect the appearance. The color of the grilled rabbit was brownish. All treatments got a like verbal rating.

Taste

Table 2 presents the taste of the food product. Stuffing grilled rabbit with lemon grass or *pandan* leaves did not have any significant effect on the taste as shown by statistical analysis. All treatments had a mean rating of 4.111 by the panel. In terms of verbal description, the panelists rated the food products with like.

Table 1. Appearance of grilled rabbit meat

| TREATMENTS | MEAN | VERBAL DESCRIPTION |
|---|---|---|
| No stuffing | 4.0166[a] | Like |
| Lemon grass stuffing | 4.1666[a] | Like |
| *Pandan* leaves stuffing | 4.1833[a] | Like |

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

Table 2.  Taste of grilled rabbit meat

| TREATMENTS | MEAN | VERBAL DESCRIPTION |
|---|---|---|
| No stuffing | 4.1000[a] | Like |
| Lemon grass stuffing | 4.1833[a] | Like |
| Pandan leaves stuffing | 4.0500[a] | Like |

Means with the same superscript are not significantly different (P≥0.05) DMRT

Tenderness

      Tenderness of the food product was rated as like by the panelists as shown in table 3. Sensory evaluation revealed that lemon grass stuffing got the highest mean which implied that addition of lemon grass stuffing on grilled rabbit meat can contribute to the tenderness of the meat better than *pandan* leaves stuffing and no stuffing at all. However, statistical analysis shows no significant difference among treatment means.

Table 3. Tenderness of grilled rabbit meat

| TREATMENTS | MEAN | VERBAL DESCRIPTION |
|---|---|---|
| No stuffing | 4.1333[a] | Like |
| Lemon grass stuffing | 4.2666[a] | Like |
| Pandan leaves stuffing | 4.2166[a] | Like |

Means with the same superscript are not significantly different (P≥0.05) DMRT

Aroma

      Table 4 presents the mean rating on aroma of different treatments. Statistical analysis shows significant differences among treatment means. Grilled rabbit stuffed with *pandan* leaves was rated significantly lowest at 3.8833. Grilled rabbit without stuffing and that stuffed with lemon grass received similar rating on aroma (4.1833 and 4.1333, respectively).  However, the verbal description for the ratings was LIKE for all treatments.

<u>Acceptability</u>

Statistical analysis shows no significant differences among treatment means. In Table 5, the verbal rating on acceptability is shown to be like for all the grilled rabbit products. This means that stuffing had no significant effect on the acceptability of grilled rabbit. However, it can be interpreted that to the panelists, all the treatments are acceptable.

Table 4. Aroma of grilled rabbit meat

| TREATMENTS | MEAN | VERBAL DESCRIPTION |
|---|---|---|
| No stuffing | 4.1333[a] | Like |
| Lemon grass stuffing | 4.1833[a] | Like |
| *Pandan* leaves stuffing | 3.8833[b] | Like |

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

Table 5. Acceptability of grilled rabbit meat

| TREATMENTS | MEAN | VERBAL DESCRIPTION |
|---|---|---|
| No stuffing | 4.0500[a] | Like |
| Lemon grass stuffing | 4.2833[a] | Like |
| Pandan leaves stuffing | 3.9466[a] | Like |

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

<u>Total Cost of Production</u>

The cost of production is shown in Table 6. Computation of cost included the rabbit meat and the materials for seasoning and stuffing only. Grilled rabbit stuffed with lemon grass incurred the highest expense of 226.67 pesos compared to grilled rabbit with *pandan* leaves stuffing (217.67 pesos) and grilled rabbit without stuffing (211.67 pesos).

Table 6. Total cost of production (Php)

| INGREDIENTS | NO STUFFING | LEMON GRASS STUFFING | *PANDAN* LEAVES STUFFING |
|---|---|---|---|
| Rabbit meat | 200.00 | 200.00 | 200.00 |
| Soy sauce | 1.80 | 1.80 | 1.80 |
| Oil | 1.50 | 1.50 | 1.50 |
| Sugar | 0.42 | 0.42 | 0.42 |
| Pepper | 1.00 | 1.00 | 1.00 |
| Onion | 5.00 | 5.00 | 5.00 |
| Garlic | 0.45 | 0.45 | 0.45 |
| Pandan leaves | - | - | 6.00 |
| Lemon grass | - | 15.00 | - |
| Butter | 1.50 | 1.50 | 1.50 |
| TOTAL | 211.67 | 226.67 | 217.67 |

# SUMMARY, CONCLUSION AND RECOMMENDATION

Summary

This study was conducted at the Meat Laboratory, Department of Animal Science, Benguet State University, La Trinidad, Benguet. The study aimed to determine consumer perception on sensory properties of whole grilled rabbit meat stuffed with leaves of lemon grass or *pandan*, and to estimate the cost of producing the grilled whole rabbit stuffed with lemon grass or *pandan*.

Whole grilled rabbit with or without stuffing was coded and presented to the panel of tasters for evaluation of the appearance, ratings of taste, tenderness, aroma and acceptability.

Results of the sensory evaluation show that all treatments almost had the same ratings in terms of appearance, taste, tenderness and acceptability. Significant difference was observed in terms of aroma. Grilled rabbit stuffed with lemon grass was the most preferred by the panelists than grilled rabbit stuffed with *pandan*. The cost of production increases with stuffing.

Conclusion

Based on the result of the study, stuffing has no significant effect on the sensory properties of grilled rabbit meat in terms of appearance, taste, tenderness, and acceptability. However, significant effects are observed in terms of the aroma of the products produced.

Recommendation

It is recommended that further sensory evaluation studies be made on the used of lemon grass and *pandan* leaves as stuffing for grilled rabbit meat.

# LITERATURE CITED

COMBES S. 2004. Valeurnutritionnelle de la viande de lapin.INRA Productions Animales, 17, 373-383. In P. Hernandez.2008.Enhancement Of Nutritional Quality And Safety In Rabbit Meat. Proc. 9th World Rabbit Congress on June 10-13, 2008 in Verona, Italy.

DALLE ZOTTE, A. 2002. Perception of rabbit meat quality and major factors influencing the rabbit carcass and meat quality.Review.Livestock Prod. Sci., 75, 11-32.

DALLE ZOTTE, A. 2004. Dietary advantages: rabbit must tame consumers. ViandesetProduitsCarnés, 23, 161-167. In P. Hernandez.2008.Enhancement Of Nutritional Quality And Safety In Rabbit Meat. Proc. 9th World Rabbit Congress on June 10-13, 2008 in Verona, Italy.

EHLER, J.T. 2012. Foodreference.com. Retrieved on August 25, 2012 from (www.foodreference.com/html/artstuffing.html).

EPICURIOUS. 2012. Recipes. Retrieved on September 7, 2012 from (http://www.epicurious.com/recipes/food/views/Chicken-Roasted-with-Lemongrass-and-Garlic-107930#ixzz267cBiQeQ).

HERNÁNDEZ, P. 2007. Carne de conejo, ideal paradietasbajas en ácidoúrico.Revistacientífica de nutrición.Nº 8 Septiembre.Boletín de cunicultura, 154, 33-36.In P. Hernandez.2008.Enhancement Of Nutritional Quality And Safety In Rabbit Meat. Proc. 9th World Rabbit Congress on June 10-13, 2008 in Verona, Italy.

HERNÁNDEZ, P. 2008. Enhancement Of Nutritional Quality And Safety InRabbit Meat. Proc. of 9th World Rabbit Congress.June 10-13, 2008 – Verona – Italy.Retrieved on October 1, 2012 fromhttp://world-rabbit-science.com/WRSA-Proceedings/Congress-2008-Verona/Papers/Q0-Hernandez.pdf

HERNÁNDEZ P. and F. GONDRET. 2006. Rabbit Meat Quality. In: Maertens L., Coudert P. (Eds.). Recent Advances in RabbitSciences.ILVO, Merelbeke, Belgium, 269-290. In P. Hernandez.2008.Enhancement Of Nutritional Quality And Safety In Rabbit Meat. Proc. 9th World Rabbit Congress on June 10-13, 2008 in Verona, Italy.

LUKEFAHR, S.D., C.V. NWOSU AND D.R. RAO. 1989. Cholesterol level of rabbit meat and trait relationship among growth, carcass and lean yield performances. J.Anim. Sci. 67:2009-2017.

MADDUL. S. B. 2000. Rabbit Production - Lecture Manual.Department of Animal Science, Benguet State University. La Trinidad, Benguet.

PETRACCI , M, M. BIANCHI and C. CAVANI. 2009.Development of Rabbit Meat Products Fortified With n-3 Polyunsaturated Fatty Acids.Nutrients1(2):111-118; doi:10.3390/nu1020111.

PLA, M ., L. GUERERO and D. GUARDIA. 1998.Carcass Characteristic and Meat Quality of Rabbit Lines Selected for Different Objectives. Livestock Production Science 54: 115-123.

RICCIO, A.V. 2006. The Italian Experienced in Heaven: Images and Oral Histories. SUNY Press.

SHADAB, Q, M. and F. CHAUDHARY. 1992. Antifungal Activity by Lemongrass Essential Oils. Pak.J.SciInd Res. 35, 246-249.

THAIFOOD. 2012. Pandan. Retrieved on July 25, 2012.from (http://thaifood.about.com/od/glossary/g/Pandan.htm).

THELITTLETEOCHEW. 2010. Roasted. Retrieved on September 7, 2012.from(http://www.thelittleteochew.com/2010/01/pandan-roasted-chicken.html).

UNITED STATES DEPARTMENT OF AGRICULTURE (USDA). 1979. Composition of Foods, Raw, Processed, Prepared.  Agric. Handbook 8. Agricultural Research Services, USDA, Washington, D.C.

VIETMEYER, N.D. 1991. MicrolivestockStudy.Board of Science and Technology for International Development. Washington D.C. Pp. 180-190.

WARREN, D.M. 1995. Small Animals Care and Management. Delmar Publisher. Albany, New York. Pp. 196-230.