**HOLY CROSS COLLEGE OF CALINAN, INC**
**DAVAO – BUKIDNON HIGHWAY, CALINAN POBLACION, DAVAO CITY**

# RAMBUTAN (*Nephelium lappaceum*) SEEDS AS ALTERNATIVE FOOD PRESERVATIVE

**Tocmo, Princess Angel T.**
**Flores, Ashley Nicole D.**
**Rosaroso, Kyra Carmella B.**
**Simangan, Riza Vaneza L.**
**Cerlos, Denzel Dwayne E.**
**Enoch, Joash Terrence Marc**

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# RAMBUTAN *(Nephelium lappaceum)* SEEDS AS ALTERNATIVE FOOD PRESERVATIVE

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of the Holy Cross College of Calinan, Inc.

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By

Tocmo, Princess Angel T.

Flores, Ashley Nicole D.

Rosaroso, Kyra Carmella B.

Simangan, Riza Vaneza L.

Cerlos, Denzel Dwayne E.

Enoch, Joash Terrence Marc

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## ABSTRACT

Food plays a very essential role in human life as it produces nutrients that are needed for daily function. However, heat, temperature, humidity, and bacteria cause food to spoil. Thus, this study was conducted find an alternative food preservative that is natural for both pork and fish meats and compare its effect against salt and no preservative at all. 250g Rambutan seeds were gathered from fresh Maharlika Rambutan fruits and were powdered through a blender. The seeds were divided unto 20g, 40g, and 60g, respectively every trial while the salt remained constant at 20g. For three consecutive days, the researchers observed the changes happening on every trial and analyzed it through sensory analysis which involved the observation of its texture, color, smell, and overall appearance, and through photo analysis. The results show that the pork preserved with the Rambutan seeds are as competent and has almost the same qualities as the one preserved with salt: it is pinkish-pale and has no smell, though their textures vary. However, the pork with no preservative turned dark and green, smelled bad, and became very soft. On the other hand, the fishes with the Rambutan seed became rotten and had the same qualities as the fishes with no preservative: eyes are red and sunken, it smells bad, and is slimy. Nonetheless, the fishes with salt still had white eyes, had a sea-like smell, and is stiff. The results indicate that Rambutan seeds can be an alternative preservative for pork meat, but not in preserving the shelf-life of fish.


*Keywords: Rambutan seed, spoilage, alternative, preservation, fish meat, pork meat,*

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# INTRODUCTION

## Background of the Study

Food is one of the body's requirements for growth and development. It has the ability to fulfill the body's nutritional needs to maintain a healthy and balanced well-being (IMPOFF- Everything Exists for a Reason, 2021; Soken-Huberty, 2023). However, food is very prone to spoilage due to many factors like heat, temperature, and other spoilage bacteria such as fungi, lactobacillus, pseudomonas, and enterobacteriaceae (Magoulas, 2016; Fifield, 2016).

Over the years, researchers found a way to prolong the shelf-life of foods through the use of preservatives. These preservatives help maintain the quality of food, including its color, texture, smell, taste, and appearance, even without the presence of a refrigerator (Zelman, 2017). However, the process of preserving food involves the usage of chemicals such as sodium benzoate, benzoic acid, nitrite, and potassium sorbate. These chemicals cause dangerous impacts on human life like asthma, cardiovascular problems, obesity, and even cancer (Anand & Sati, 2013; Alsofi, Hemaram, Murugan, & Sambu, 2022). Salt, despite being a good preservative, can also induce adverse health effects like high blood pressure, kidney problems, stomach cancer, and Nastopharyngeal (Ali, 2024).

Rambutan *(Nephelium lappaceum*) is fruit grown and abundant in Southeast Asia including the Philippines and has been found to contain antimicrobial and antioxidant properties (Barode, 2023). In Malaysia, the dried peels of Rambutan (*Nephelium lappaceum)* seeds are used as an antidiabetic solution. In further studies conducted in 2012 and 2016 by Chinese Scholars, it is stated that Rambutan *(Nephelium lappaceum)* seeds have the potential to be used in food processing (Azzatul et al., 2020).

The researchers have come up with the idea to create a natural alternative for food preservatives to lessen its negative effects to the health. More so, this study also seeks to determine whether or not if the powdered *Nephelium lappaceum* seeds have the ability to preserve pork and fish meat and assess if Rambutan *(Nephelium lappaceum)* seeds have the ability to preserve pork and fish meat even after 24 hours, 48 hours, and 72 hours, and if Rambutan *(Nephelium lappaceum)* seeds can preserve pork and fish meat better than salt, and no preservative at all.

**Statement of the Problem**

This study aims to determine whether or not Rambutan (*Nephelium lappaceum)* seeds have the ability to prolong the shelf life of pork and fish meat and be an alternative preservative for the above stated meats. It seeks to answer the questions:

1. How long can Rambutan (*Nephelium lappaceum)* Seeds preserve the following:
    1.1 pork meat; and
    1.2 fish meat?
2. Will there be any changes to the pork and fish meat after the application of Rambutan *(Nephelium lappaceum)* Seeds in terms of
    2.1 color;
    2.2 texture; and
    2.3 smell?
3. What will be the changes in the color, texture, and smell of the pork meat after being cured after:
    3.1) 24 hours;

3.2) 48 hours; and

3.3) 72 hours?

4. What will be the changes in the color, texture, and smell of the fish meat after being cured after:

4.1) 24 hours;

4.2) 48 hours; and

4.3) 72 hours?

5. How much Rambutan seed is needed to preserve

5.1 fish meat; and

5.2 pork meat?

6. In which meat, pork or fish, can Rambutan *(Nephelium lappaceum)* seeds preserve better?

7.Is Rambutan (*Nephelium lappaceum)* Seed better in preserving pork meat when compared to:

7.1 no preservatives at all; and

7.2 salt?

8. Is Rambutan *(Nephelium lappaceum)* Seed better in preserving fish meat when compared to:

8.1 no preservatives at all; and

8.2 salt?

**Hypothesis**

1. The use of Rambutan (*Nephelium lappaceum*) seeds as an alternative food preservative will prolong the shelf life of raw pork and fish meats.

## METHODS AND MATERIALS

This investigatory project is a qualitative study as it will test the quality of food, specifically pork and fish meat, after the application of Rambutan (*Nephelium lappaceum)* seeds as its alternative preservative. It will have both controlled and experimental groups. Under the controlled group, the pork and fish meat will be exposed to air at a certain span of time without any preservative. Under the experimental group, the same amount and kind of pork and fish meat will still be exposed to air at a certain span of time but it will now have the application of a commercial preservative which is salt, and the alternative preservative of *Nephelium lappaceum* seeds as comparative factors. The independent variable will be the Rambutan *(Nephelium lappaceum)* seeds and the salt. The dependent variable will be the effect of the above stated factors on the color, smell, and texture of the pork and fish meats. The controlled variables will be the kind and amount of the pork and fish meat, the span of days it will be, and the environment in which the test subjects are going to be put at. The experiment will have four phases namely, Phase I- Materials and ingredients used, Phase II- Application of powderized Rambutan seeds, Phase III- Data gathering and analyzing, and Phase IV- Disposal of materials and ingredients used.

### Phase I- Materials and ingredients used

The study used a specific variety of Rambutan, which is the Maharlika variety, and it was bought from the Calinan Public Market. The researchers collected 5 kilogram of Rambutan fruit and gathered 250 grams of Rambutan seeds all in all after peeling it out from the fruit which will be divided for the two set-ups, with each set-ups having three trials with 20g, 40g, and 60g Rambutan preservative applied to each trial respectively. The

researchers also bought 1.8kg of pork meat and another 1.8kg of fish meat. Aside from that, the study requires eighteen 20g of iodized salt for the controlled set-up which will be the basis of comparison along with the no-preservative group. The researchers also used other materials such as measuring cups to properly measure the amount of of independent variables, a weighing scale to measure the weight of the dependent variables, small platters to which the researchers put the meats, blender to powderize the seeds, and a cling-wrap to secure the meats during curing. The researchers followed the method of Bennett in 2022, where foods are coated with powderized preservatives—also called the curing method.


200g of Pork Meat


50g Salt


60g Rambutan Seed


20g Rambutan Seed


40g Rambutan Seed

Maharlika, Rambutan

Blender


200g Fish Meat

**Phase II- Application of powderized Rambutan *(Nephelium lappaceum)* seeds**

The researchers separated the two set-ups: one for the pork meat and one for the fish meat. Each set-up will have three trials. On the first trial, the researchers coated both the pork and fish meats with 20g rambutan seeds each; on the 2nd trial, the researchers coated both the pork and fish meats with 40g rambutan seeds each; and for the 3rd trial, the researchers coated both the pork and fish meats with 60g rambutan seeds each. For all the trials of both the pork meat set-up and the fish meat set-up, the amount of iodized salt remains controlled, which is 20g. Another controlled variable are the pork and fish meats who have no preservatives added on them for every trial and for every set-up. After coating all the pork and fish meats with their designated preservative and setting them up to a condition they are supposed to be in, the researchers wrapped each platter with a cling-wrap so it would not be contaminated with its surrounding environment and conditions are remained controlled. The set-ups are placed on a common environment with the same room temperature. The Science Lab in-charge, Mr. Sipot Jr., validated the researchers' observation for three days. After that, the researchers will make their analysis out of the observed changes.

Set up 1 & 2- Trial 1

Set up 1 & 2- Trial 2

Set up 1 & 2- Trial 3

**Phase III- Data gathering and analyzing**

For three days, the researchers observed the changes happening in all the pork and fish meats. The researchers took note of these changes every 5:00 pm each day to assess and take down notes of their observations. This type of analysis is called a sensory analysis. A sensory analysis inspects the texture, appearance, smell, and taste using the five senses (Ruiz-Capillas & Herrero, 2021). The same study also proves that sensory analysis has been used in the food industry for a long time now to determine product quality. However, the study does not include the evaluation of taste since the researchers observed raw meats. Another method that was used by the researchers was the process of photo analysis. Photographs has been proven to play a huge role in research as it gathers visual evidence that helps track changes for a qualitative study (Cleland & MacLeod, 2021).

**Phase IV- Disposal of materials and ingredients used**

The researchers at the end of the experimentation and every observation, cleaned and washed the used materials. The peels of the fruit as well as other excess trash were properly segregated and were thrown away to their respective garbage bins. The researchers then washed their hands thoroughly.

## RESULTS

This study determined the effectiveness of Rambutan (*Nephelium lappaceum*) seeds as an alternative food preservative as presented by the following tables:

**Research Question 1, 2, 3, 4, 5, 6:** What are the changes in the color, smell, and texture of the pork and fish meats after being preserved for 24 hours, 48 hours, and 72 hours? How much Rambutan (*Nephelium lappaceum*) seeds are also needed to preserve the pork and fish meats?

**Table 1: Fish and Pork Meats with Rambutan Seed**

| Set-up | Days | Trials and Documentation | | |
|---|---|---|---|---|
| | | Trial 1 (20g) | Trial 2 (40g) | Trial 3 (60g) |
| Fish | Day 1 |  Dry, has yellow eyes, smells a little, and hard. |  Dry, has yellow eyes, smells a little, and hard. |  Dry, has yellow eyes, smells a little, and soft. |
| | Day 2 |  Eyes were red, became soft, and was attacked by worms, and smells bad. |  Eyes are red, became soft, has a pungent smell. |  Eyes are yellow, hard, smells bad. |
| | Day 3 |  Eyes are very red, very soft, slimy, smells very bad. |  Eyes are very red, smells very bad, and was attacked by worms. |  Eyes are red, smells bad, hard, and slimy. |
| Pork | Day 1 |  No smell, pale, and soft |  No smell, pinkish, and soft |  No smell, darkened, soft on the fat part |
| | Day 2 |  Hard, water is coming out, pale, has no smell |  Soft fat part but hard flesh, pale, no smell, and has no moisture anymore |  Pinkish, fat is soft but meat is hard, no smell |
| | Day 3 |  Has little smell, hard, pale |  Has no smell, tender, and pale |  Has a little smell, hard, and pinkish |

Table 1 shows that the Rambutan preservative was not effective in preserving the texture, color, and smell of fishes. The fishes, even on the first day of observation, started developing yellow eyes and were emitting a bad smell. On the second and third days, the smell became even more pungent. The observations from the past days also show that the fishes with 20g-40g of Rambutan smelled worse than that with 60g. On the other hand, the pork meats being preserved with Rambutan seeds did not release any bad smell until the third day, which is only moderate. The color also remained pale and pinkish. Lastly, the texture remained soft and squishy. It is also noted that the pork with 40g of Rambutan did not emit any bad smell at all.

Table 2, that is found on page 10, shows that salt is an effective preservative in preserving both pork and fish meats especially after 1 to 2 days of application. The fishes, as shown on the figure above, still had white eyes even after three days. The fishes also did not produce any kind of smell aside from a sea-like odor it was emitting. The texture of the pork meat, however, was contradicting from the texture of those that are cured with the Rambutan seed as it is hard, with the fat part being an exception. The meats cured with salt also produced water, as if all its moisture was coming out of it. The color started from being pinkish, maintaining the same hue it had when it was freshly bought from the market, but on the second day, some of the meat darkened, and grey streaks started to appear especially on the flesh part. Nonetheless, all throughout the three days observation process, none of the pork meats, may it be from trial 1, 2, or 3, produced any form of bad or rotten smell.

**Research questions 7 and 8:** Are Rambutan (*Nephelium lappaceum*) seeds better than salt in preserving pork and fish meats?

**Table 2: Fish and Pork Meats with Salt**

| Set-up | Days | Trials and Documentation | | |
|---|---|---|---|---|
| | | Trial 1 (20g) | Trial 2 (20g) | Trial 3 (20g) |
| Fish | Day 1 |  Still moist, no smell, and hard. |  Hard, no smell, eyes were still white.. |  Eyes were still white, hard, no smell. |
| | Day 2 |  Hard, eyes were red, smells bad. |  Turned hard, grey, eyes were yellow, has a little smell. |  Eyes were white, soft abdomens, hard body, no smell. |
| | Day 3 |  Eyes were still white, hard, and has a little smell. |  Eyes were white, hard, has a little smell. |  Hard and dry, eyes were white, has a little smell. |
| Pork | Day 1 |  Firm, and pinkish but has darkened a little bit, smelled a little. |  Fat part is hard, and pinkish. |  Hard, fat part is hard and pinkish. |
| | Day 2 |  Pale, very hard, no smell. |  Very hard, water comes out of meat, pale but darkened a little. |  Hard, pale, no smell. |
| | Day 3 |  Hard, pale, and no smell. |  Hard, pale, and no smell. |  Hard, pale, and no smell. |

**Research Questions 7 and 8:** Is applying Rambutan (*Nephelium lappaceum*) seeds, the alternative preservative, better than not applying any preservative at all?

**Table 3: Fish and Pork Meats with No Preservative**

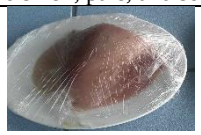
| Set-up | Days | Trials and Documentation | | |
|---|---|---|---|---|
| | | Trial 1 (20g) | Trial 2 (40g) | Trial 3 (60g) |
| Fish | Day 1 |  Rotten smell, eyes were yellow, hard at the stomach. |  Red eyes, very dry, and smells pungent. No moist from within |  Dry, has bruises, eyes are red. |
| | Day 2 |  Hard, smells rotten, and has bruises. Eyes were red |  Rotten to the core, has bruises, eyes were red, very soft |  Eyes were yellow, hard, and smelled bad. |
| | Day 3 |  Eyes were very red, very soft, slimy, and smelled very bad. |  The eyes were sunken, smelled very bad, and was attacked by worms. |  Eyes were sunken, smelled very bad, hard, slim |
| Pork | Day 1 |  No smell, pale, and soft |  No smell, pinkish, and soft |  No smell, darkened a little, and soft, especially on the fat part |
| | Day 2 |  Hard, water is coming out, pale, and has no smell, dark |  Soft fat part but hard flesh, dark, no smell, and has no moisture anymore |  Discolored, fat is soft but meat is hard, no smell |
| | Day 3 |  Has a bad smell, hard, dark, has bubbles |  Has bad smell, is soft, and dark |  Has a bad smell, hard, and dark and yellowish. |

Table 3 shows that applying no preservative to both the pork and fish meats causes it to rot even after just 24 hours. The fishes, after 1 day, produced a smell similar to what decomposed and rotten organisms produce. Other than that, the fish became very hard and stiff. It is also important to note that only on this clause did the eyes of the fish sunk. The pork meat had a severe discoloration, aside from grey streaks, colors such as yellow and green started to appear. The texture was also very soft, even softer than those that are cured with the Rambutan seeds. Lasty, the smell it produced was far from tolerable, it smelled very bad and rotten even just after a day.

## DISCUSSION

The results shows that the fishes with the Rambutan (*Nephelium lappaceum*) seed preservative, after 24 hours, produced a bad smell, became slimy and hard, and the eyes turned yellow, which eventually, after three days, became worse. This is an indication that the fish is already rotten and is not anymore safe to consume (Nagy, 2023). However, the pork that was preserved by the Rambutan (*Nephelium lappaceum*) seed is still pale, white on the fat part, soft, and produces no pungent smell, especially the one with the 40g Rambutan (*Nephelium lappaceum*) seed powder applied. Though the hardness varies from the one preserved with salt, the above stated qualities still prove that the pork meats, especially on days 1 and 2 are still proven to be fresh and safe to consume as supported by studies conducted by Burry (2023). This indicates that Rambutan (*Nephelium lappaceum*) seed is more useful on preserving the shelf-life of pork than that of a fish. This is caused by the inflated tropical temperature the fishes experience after being caught that is far from their nature which makes enzymes, lipid oxidation, and microbes grow faster than how it is supposed to be (Ali, et al., 2022); this stance was what the seeds of Rambutan (*Nephelium lappaceum*) were not able to catch up with.

Other than that, the result also shows that the fish meats, since day 1 up until day 3, though having tiny setbacks and differences each day, remained tolerable in the sense that the flesh still bounces back when it is pressed, the eyes are still white, the skin still has its sheen, and the odor still smells like the sea. All of these imply that the fish is still fresh and is not yet rotten (Kraugerud, 2021; Zhang, Sun, Sang, Jia, & Ou, 2022). These results are further supported by a study of Peñarubia (2021) that shows how salting reduces the

water activity in fishes and even on pork meat, thus preventing the growth of most spoilage bacterias that thrive on wet environment.

Lastly, the results present that the fishes without any preservative, after 1 day, turned smelly, developed a red eye, turned gray, became stiff, and had bruises, which, eventually, became worse after 3 days. Supported by the study of Macpherson (2022), Loss (2023) and Nagy (2023), this occurence signify that the fish is already rotten because fresh fish should have a salty smell, resembling the ocean, whereas, odors beyond this signifies spoilage. Still from the study of Loss, bacterias from the insides of the fish turn an amino acid called lysine into a molecule called cadaverine which is responsible for the decomposition of animals and thus producing a dead-like odor. Table 3 also shows that the pork meats without any preservative, after a day, darkened, turned greenish-grey, became slimy, and produced a pungent smell, and turned even worse after 3 days, all of which, indicate that the meat is already spoiled and is not anymore safe to eat (Fullmer, 2013; The Express Tribune, 2015). This occurrence, according to Iulietto, Sechi, Borgogni, and Cenci-Goga (2015) happens because of the disintegration of the pork's carbohydrates, protein, and fat, and thus making it unfit for human consumption.

# CONCLUSION AND RECOMMENDATIONS

## Conclusion

Based on the results of the experimentation, it can be concluded that Rambutabn (*Nephelium lappaceum*) seeds, specifically with the measurement of 40g, are effective to prolong the shelf-life of pork meat but only up to 3 days. However, it cannot be used as an alternative preservative for fish meat no matter the measurement is. Therefore, Rambutan (*Nephelium lappaceum*) seeds preserve pork meat better than fish meat, and can be an alternate method to cure and prolong the shelf-life of raw pork.

## Recommendations

The researchers recommend the future researchers to use other type of meat other than fish and pork, to use a different method of application aside from curing, to use a different variety of Rambutan, to use a sliced fish instead of a whole fish, to use other types of fish aside from Caraballas, and to cook the preserved meat. The researchers also recommend the public to use Rambutan (*Nephelium lappaceum*) seeds as an alternative preservative for pork meat at times of resource scarcity or at times of wanting to live a more natural and healthy life.

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