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NUTRITIONAL EVALUATION ON FERMENTED PERAH SEED

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ABSTRACT

Fermentation of seeds to prolong food shelf life and preserve their nutritional values are crucial to provide health benefits. Yet the analysis on the content of fermented perah seeds was scarce to determine its usability and availability as alternative nutrient supplier. Therefore, this study aimed to investigate the difference in nutritional value of perah seeds before and after the fermentation. Fermentation of perah seed was done by immersing the fresh seeds into salt water for two weeks while fresh seeds as non-fermented seeds. Results revealed that the fermented perah seed was light brown in colour and had pleasant smell. Proximate analysis demonstrated that fermented seed contained lower moisture content (0.85%), protein fibre (12.94%) and ash (2.89%) compared to non–fermented perah seed. Interestingly, the fat content increased after fermentation process for about 9% but other nutritional values decreased slightly. However, the decrease in protein content after the fermentation was very small which was less than 4%. It inferred that good preservation of protein content was shown in the fermented Perah seed. For mineral analysis, fermented perah seed demonstrated a reduction in heavy metal amount compared to non-fermented seed. Taken together, fermented perah seed was better in term of protein preservation, shelf life and decrease of heavy metal content compared to non-fermented Perah seed to provide beneficial health effects.

Keywords: Fermented, non-fermented, perah seed, elastreospermum tapos, protein and proximate composition

1.0 INTRODUCTION

Practice of fermentation have been done long time ago for extend the shelf life purpose as well as to improve nutritional and sensory qualities of food. The growing interest in health care benefit has led to increased application of fermentation on seeds especially edible seeds. This is because seeds are proven as potential sources of many important nutrients and functionalities with the presence of important proteins in them [1],[2]. Perah seed or

scientifically known as *Elateriospermum tapos* is one of the attractive edible seeds. It has shown a great potential of nutritious content include omega-3 fatty acid and α-linolenic acid that are very useful to humankind [3]. Consequently, Perah seed is a seasonal seed that need to be fermented to prolong its shelf life. There are several seeds that are known as the fermented based instead of the non-fermented seeds such as soy bean seed [4], pumpkin seed [5] and some African oil bean seeds include *Pentaclethra macrophylla Benth* [6]. Researcher stated that the fermentation of seed increased its shelf life and reduced the antinutritional value in the seed [7]. Researcher also highlighted that fermentation markedly improved the digestibility, nutritive value and the flavor of the seed. Fermented products remain of interest since they do not require refrigeration during storage which could greatly reduce the processing cost and complexity. However, the fermentation process might cause nutrient loss in the seed. It seems to be worthless if the shelf life of the seed can be extended by fermentation process but not the nutrient. To date, the study on the effect of fermentation on perah seed's nutritional value, physical and chemical properties are limited. Therefore, this study aimed to compare the nutritional value of fermented and non-fermented perah seeds in order to reduce the nutritional value loss during fermentation.

2.0 METHODOLOGY

2.1 Preparation of Seed Powder

Fresh perah seeds were obtained from the perah farm at Hulu Terengganu and cleaned from the dirt and dust. The seeds were screened accordingly to their physical condition where damaged seeds were discarded. The selected seeds were then separated into two groups: non-fermented and fermented seeds. The fermented perah seeds were prepared by boiling it with water and stored them in a bottle filled with salt solution for two weeks. The procedures for making the selected good seeds into powder were referred to previous work [8] with modification. Firstly, the seeds were peeled out the kernel shell and dried at 50°C for 24 hours in the oven. Subsequently, a drying blender was used to set the seed into powder. The powdered seeds were homogenized by using mesh wire with 1 millimeter in size. The homogenized seeds were then stored in screw cap bottles and kept at room temperature for further analysis.

2.2 Physicochemical Properties Analysis

Physicochemical properties were done based on visual observation to characterize the seeds prior to the chemical analysis. The analyses involved were the seed texture, shape, colour and smell based on its appearance

2.3 Proximate Composition

Proximate analysis include moisture content, crude fat, crude fiber, crude protein and ash was done to investigate the chemical properties of perah seeds. Differential proximate between perah seeds with different kind of seeds that have been studied previously were compared. The nutritional content was determined according to the previous experimental methods include moisture content [9], crude fat and ash [10], crude fiber and crude protein [11] as described following. 200 mL of boiled 0.25N H_2SO_4 was poured into 500 mL conical flask containing 2g ground seed. The sample was stirred and crushed with glass rod. After that, it

was refluxed for 30 minutes and filtered using ashless filter paper. The retentate was rinsed with distilled water until it is neutral. The residue was then placed back in the previous cone flask and added 200 mL of boiled 0.313N NaOH. The mixture was refluxed again for 30 minutes and filtered with ashless filter paper. To remove its alkalinity, the residue was rinsed with boiled distilled water and rinsed again with small amount of alcohol prior to the filtration. The residue and ashless filter paper were placed in crucible and dried at 105°C. The crucible and its content were measured at regular time interval (24 hours). The drying and measuring process were repeated until a constant weight was obtained. Dried sample was placed in Mufel furnace at 550°C and was heated to ensure no black particle was seen. Ultimately, the crucible and its content were placed in a dried flask and measured the weight regularly to achieve a constant weight.

In the preparation of PANI, 400 mL of 0.05M APS in 1M of HCl was added dropwise into 400 mL of 0.1M aniline in 1M of HCl, and stirred vigorously for 30 minutes, followed by continuous stirring for 8 hours with moderate speed. Then, it was kept overnight and filtered afterward by vacuum filtration. Methanol was used to remove the unreacted aniline and distilled water was used to wash away the methanol during the filtration. Next, the leftover PANI cake was dried at a temperature of 80ºC in oven. After that, the dried PANI cake was grinded into powder using pestle and mortar.

2.4 Mineral Analysis

The powdered seed was analyzed by ICP-MS analyzer, ELAN 6100. 6100. The crossflow nebulizer at 1.2 mL/min with 0.75mm i.d peristaltic pump with pump speed 24 rpm.

3.0 RESULTS AND DISCUSSION

3.1 Physicochemical Properties of Perah Seed

The physical properties of the perah seed were observed for both non-fermented and fermented seeds as shown in Table 1.

Table 1 Physical characteristics of perah seed

Properties	**Type of Perah Seed**	
	Non-Fermented	**Fermented**
Texture	Not smooth	Smooth
Shape	Ellipse	More shrinkage than fresh seed
Colour	Brown	Light brown, more to orange
Smell	Less smell	Unpleasant smell

Table 1 depicted that the fermented seed had an unpleasant odor compared to fresh seed due to the fermentation process. Besides that, fermented perah seed tended to have smooth texture and also more shrinkage compared to fresh seed owing to less moisture content. Another observable attribute of fresh and fermented perah seed was the colour. The fermented seed had a very interesting light brownish colour, more towards orange as compared to non-fermented seed that was brown in colour.

3.2 Proximate Analysis on Non-Fermented and Fermented Perah Seed

The difference in term of the chemical properties of non-fermented and fermented perah seeds were compared in Figure 1. Results demonstrated that moisture content in fermented seed was significantly lower than that in non-fermented seed, approximately 97.7% reduction in moisture content. This was attributed to the transferring of moisture from perah seeds to external environment during the fermentation process. Similar result was reported in which the moisture content in fermented perah seed was reduced by 86.4% [8]. Significant reduction or in other word, lower moisture content added value to perah seed. This was because low moisture content could suppress the activity of fungi that spoil the seeds thereby extending the seeds shelf life. Lower moisture content seeds could also be easily stored in refrigerators especially where they are abundantly available during their peak season. This would further improve the availability and supply of perah seeds during the off season since fermented seeds could be stored for longer time.

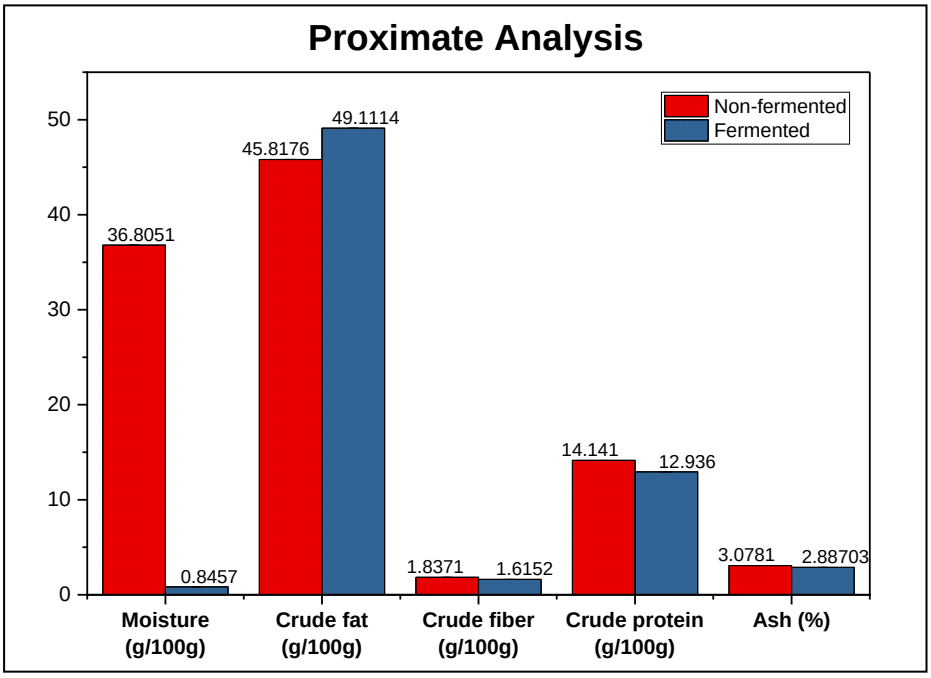

Figure 1 Comparison of proximate analysis between fermented and non-fermented Perah seed

The content of crude fat was 7.19% higher in fermented seed as compared to non-fermented seed. This value compared well with those of [4] and [8] where fat from fermented soy bean seed and perah seed increased significantly. Nevertheless, the increment was comparable with that found in perah seeds during microwave cooking (5.7% higher crude fat) with significant reduction in moisture content (33.1% lower) compared to non-microwave cooking [12]. This could be deduced that crude fat was directly influenced by moisture content regardless of the preservation method. On contrarily, crude fiber displayed the reduction pattern in fermented seed, approximately 12.8% reduction compared to non-fermented seed. This was due to the inability of the microbial agents to synthesize celluloses and hemicelluloses for the hydrolysis of complex polysaccharides in the seed [6]. Comparable reduction (8.5%) was shown in crude protein also where non-fermented seed had approximate 2.0 gram higher crude protein than fermented perah seed. It was in good agreement with the observation of [8] as the crude protein reduced by 4.3% in fermented

perah seed. It is inferred that crude protein content was not affected much by the fermentation process. However, these results were contradicted to the work done in previous work [6] as researcher claimed that higher protein (3.2% increment) was found in African oil bean (*Pentaclethra macrophylla Benth*) after fermentation. Researchers proposed that the fermenting microorganism such as *Bacillus* species induced the action of extracellular enzymes to provide proteases [13]. These extracellular proteases would hydrolyze the complex plant proteins to amino acids and lower molecular weight peptides thereby decreased the crude protein content ultimately.

The last proximate analysis was the ash where the content in non-fermented seed tended to be higher compared to fermented seed. The ash content in non-fermented seed was decreased from 3.08% to 2.89% in fermented seed. Negative trend was indistinguishable with the reported results [4] and [8] where the ash content were 3.36% and 3.22% respectively. However, the differential ash content between fermented and non-fermented seed was neglectable small. The low ash contents for both perah seeds showed that there could be more potential contents that need to be discovered besides those chemical contents mentioned. Further analysis should be developed to look up for other nutritional values (polyphenols, flavonoids) or functional properties (antioxidant, anticancer, antinutritional) in the perah seed as high antioxidant activity of perah seeds extracts were reported [12],[14],[15].

Overall, the proximate analysis showed that the less moisture content in fermented seed would be beneficial for long term storage and low content differentials of fresh seed, compared to fermented seed in useful nutrients such as crude fat and crude fiber. This is advantageous for fermented seed as it means that it can be supplied in all seasons. The study also inferred that the useful nutritional value such as crude protein, crude fiber and crude fat in perah seed had higher content than in soya bean studied [16]. This deduced that perah seed could be used as a new source of valuable nutrient content, for example protein, besides soy bean. Less moisture content in perah seed would also result in longer shelf life of its flesh or oil as compared to soy bean. Moreover, there was just a slightly decreased value of nutritional content in fermented compared to fresh perah seed; this gave extra credit in terms of the longer-lasting stock during the end of the season.

Furthermore, the mineral content was also been analyzed to determine the content accurately. High concentration was discovered in the fermented seed for potassium, iron, magnesium and nickel as compared to non-fermented seed. These could be advantageous as potassium is known for maintaining blood pressure, calcium for the bones and sodium for maintaining acid-base in the human body. Besides that, the mineral content in Table 2 also depicted that the seed had heavy metal contents such as lead, copper, arsenic, iron, nickel cadmium, mercury, cobalt and silver. Yet the amount was still tolerable in referring to the National Institute of Health standards.

Table 2 Mineral analysis of perah seed

Composition (ppm)	Fermented Perah Seed	Non-fermented Perah Seed
Aluminium, Al	0.3	0.34
Arsenic, As	0.04	0.05

Barium, Ba	0.03	0.04
Cadmium, Cd	0.002	0.004
Calcium, Ca	34.62	35.07
Chromium, Cr	0.08	0.08
Cobalt, Cr	0.002	0.002
Copper, Cu	0.13	0.72
Iron, Fe	9.8	9.77
Lead, Pb	0.01	0.04
Magnesium, Mg	1.93	1.82
Mercury, Hg	0.0001	0.0001
Nikel, Ni	0.15	0.14
Phosphorus, P	ND (<0.003)	ND (<0.001)
Potasium, K	26.19	19.08
Selenium, Se	0.01	-0.02
Silver, Ag	0.0004	0.0004
Sodium, Na	22.18	43.66
Zinc, Zn	5.94	9.35

4.0 CONCLUSION

Perah seed is commonly used only by the locals as their source of food. However, perah seed has not been recognised for its potential in nutritional contents. The physical characteristic from the observation demonstrated how the fermentation process had affected the odor, color, shape and texture from its original or the non-fermentation perah seed. It was found that fermented perah seed was prone to have smooth texture, shrink shape and light brown in colour with pleasant fragrance. The abundant availability of perah seeds in Malaysia makes perah seed to become one of the nutritional sources especially in protein content. The measured nutritional content of both fermented and non-fermented perah seed was comparable but fermented perah seed had great reduction in moisture content. It was beneficial as low moisture content could inhibit the growth of microorganism thereby could preserve the food shelf life for a longer period. The comparable crude protein of fermented seed achieved in this study could make it as attractive alternative source of protein extraction for health benefits. This could provide insightful preservation method to maintain nutrients in perah seed by utilizing time and cost-effective fermentation. Overall results were lower than previous report perhaps due to differences in agricultural practices of growing and equipments used in the experimental works. However, the slightly different nutritional content on non-fermented seed from fermented seed would be an added value to the long storage and its availability in all seasons.

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