Research Article

Formulation Development of Pandanus Rabbit Feed Pellet by Using One-Way ANOVA Approach

Muhamad Hissammuddin Shah Bin Zainal Abidin[1,*], Aidee Kamal Bin Khamis[2], Nurul Afiqah Alya Binti Sapari[1], Nurul Nabila Binti Mohammad Pauzan[1], and Nur Fatin Aqilah Binti Alias[1]

1 Politeknik Tun Syed Nasir Syed Ismail, Hab Pendidikan Tinggi Pagoh, KM 1, Jalan Panchor, Muar, Malaysia.

2 Ibnu Sina Institute for Scientific & Industrial Research (ISI-SIR), Block N31, Universiti Teknologi Malaysia (UTM), Johor Bahru Campus, Malaysia.

* Correspondence: hissam@ptsn.edu.my; 06-9742288.

Abstract: *In the rabbit breeding industry, the exorbitant cost of animal feed is the primary concern. Rabbit breeding costs can be reduced by utilizing inexpensive and easily accessible materials. This study aims to develop and explore the potential value pandan leaves (Pandanus amaryllifolius), which are well-known for their aromatic properties and culinary applications to produce commercial low-cost pellets. In the formulation development, pandan leaves were combined with rice bran, corn, soybeans, molasses and salt to produce pellets of superior quality. The methodology applied is to evaluate the general acceptability of pellets based on sensory properties including shape, color, texture, fragility, odor, and overall acceptability. Then, the percentage of crumble analysis was calculated that show the better quality of the pellets. This study used commercial pellets as a control. The statistical methods applied for data analysis were one-way ANOVA. The results analysis of the 30 panelists showed that the formulation 3 was no significant different compared to commercial pellet (control) for attribute shape, texture, fragile and overall acceptance. On the other hand, formulation 3 was better than commercial pellet for attribute color and odor. According to the percentage of crumble analysis, formulation 3 has the lowest value (3.15%) shown better quality of the pellets. Overall, formulation 3 that contain 35% of pandan leaves was selected as the best formulation from 3 formulation developed based on sensory qualities of pellets and percentage of crumble analysis.*

Keywords: pandan leaves; rabbit pellet; animal feed.



Copyright: © 2023 by the authors. Submitted for open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. INTRODUCTION

Rabbits are pseudoruminant animal that require high-fiber sources of food (Tistiana et al., 2020). The digestive system of rabbits can survive on a diet of fresh plants, but fresh plants are unsuitable for commercial rabbit breeders because they cannot be stored for extended periods of time (Razman et al., 2023). Therefore, pellets are an ideal alternative to fresh plants for providing complete nutrition to rabbits. As time passes, the price of rabbit food pellets continues to rise, which is one of the most significant issues facing the rabbit breeding industry (Razman et al., 2023).

Pandan leaves, also known as *Pandanus amaryllifolius*, have been used for a very long time especially in South East Asian for a variety of purposes, including as natural flavors and colors, in traditional medicine, and in the preparation of a wide variety of foods (Ningrum & Schreiner, 2014). In almost all places of Malaysia, whether they are villages or cities, pandan leaves are widely cultivated. The use, cultivation, and commercialization of pandan leaves are also the subject of extensive research

because of the potential in their nutrition value (Ningrum & Schreiner, 2014). This abundant plant can be one of the most important especially in the sources of fibre in the formulation of rabbit pellets, which are essential for the growth of rabbits.

There are numerous factors that can be applied to determine the physical quality of pellets, including the nutritional composition of the feed, the particle size of the material, the storage temperature and duration, and the moisture content (Ghasemi & Chayjan, 2019). According to Muramatsu et al., (2015), the quality of pellets is defined by their ability to withstand fracture and abrasion during handling without crumbling and to reach the feeder without producing an excessive amount of fines. On the other hand, prior research has demonstrated that feed formulation in pellet production has the greatest impact on pellet quality. A formulation of pellets that must contain sufficient amounts of protein, fibre, and fat for supplying the nutritional needs of rabbits. Therefore, it is essential that researchers choose ingredient for pellet formulation with a high nutritional content for optimal rabbit growth.

Although research on the quality of animal pellets has been conducted extensively, there has been little published research on discovering and optimizing rabbit feed pellets. The aim of this research is to use of pandan leaves in combination with other ingredients such as rice bran, corn, soybeans, molasses, and salt to explore its potential as an animal feed ingredient that can produce of high-quality low-cost pellet. Researchers and people who breed rabbits will be able to benefit from the findings of this study, which will help encourage the sustainable use of resources.

2. METHOD & MATERIAL

2.1 Material

Pandan leaves, rice bran, corn, soybeans, molasses, and salt were purchased from local supplier.

2.2 Raw Material Preparation

The method for preparing basic materials begins with drying, grinding, weighing, and mixing of all the ingredients, followed by pellet formation (Razman et al., 2023). The drying process is critical for maintaining pellet quality by controlling moisture content, hardness level, and pellet texture. The drying process takes two days at a temperature of 70 °C. Pandan leaves and other materials such as soybeans and corn are grinded till fine after drying. This step, along with the sieving process, was done multiple times to achieve a powder-like product. Depending on the amount of material, this process takes about a day. This process takes about 2-3 days, depending on the amount of material. After the drying and grinding processes have been completed, the materials were be weighed. The ingredients were weighed in accordance with their specific formulations. Finally, the ingredients are combined until consistent. The combined materials are then put into a pellet machine to become the finished rabbit pellets product.

2.3 Formulation Development

The pellet formulation preparation method was referred from the Razman et al., (2023). Three formulations were developed based on the percentage of weight (%) for this study (Table 1).

Table 1. Formulation of rabbit pellet.

Ingredient	Formulation 1	Formulation 2	Formulation 3
Pandan leaves	35	20	35
Rice bran	30	30	30
Corn	15	15	15
Soybean	1	15	15
Molasses	18	19	4
Salt	1	1	1

2.4 Sensory Analysis of Rabbit Pellet

Thirty untrained panelists from Politeknik Tun Syed Nasir Syed Ismail participated. The panelists had been briefed on the instructions for the general acceptability testing (hedonic test) on the product in general. The general acceptability of pellets based on sensory properties including shape, color, texture, fragility, odor, and overall acceptability was studies on three random code developed formulation (Table 2). In this panelists nine-point hedonic scale (1 = dislike very much, 9 = like very much). The index of acceptability (IA) was calculated according to Fernandes & Salas-Mellado, (2017) as shown in Equation 1.

$$\text{IA \%} = \frac{Score}{9} \text{ x } 100 \quad (1)$$

Table 2. Coding of sample.

Code	Sample
163	Commercial pellets (Control)
725	Formulation 1
190	Formulation 2
733	Formulation 3

2.5 The Percentage of Crumble Analysis of Rabbit Pellet

The percentage of crumble analysis was calculated that show the better quality of the pellets. In this study, once the pellet was formed using a pellet machine, it was sieved to separate the pellet form and unform pellets (powder) (Razman et al., 2023). The percentage of crumble analysis was calculated as shown in Equation 2.

$$\text{percentage of crumble} = \frac{weight\ of\ powder}{weight\ of\ pellet} \text{ x } 100 \quad (2)$$

2.6 Statistical Analysis

This study developed a pellet formulation with pandan leaves as the main ingredient using the One-Way ANOVA approach for determining if there are statistically significant differences between the means of the three formulations. The data analyzed using SPSS software 26 version.

3. FINDINGS AND DISCUSSION

3.1 General Acceptance (hedonic test)

General acceptance of sensory evaluation is a scientific method employed to measure and analyze human responses to various sensory attributes about different products. This evaluation

process plays a crucial role in understanding consumer preferences, assessing product quality, and determining overall acceptability (Fernandes & Salas-Mellado, 2017). One widely used approach in sensory evaluation is the hedonic test as it is a popular method in sensory evaluation that tries to evaluate participants' level of liking or disliking a product. The findings of the general acceptance of pellet assessment (hedonic test) are shown in Table 3.

Table 3. Hedonic test result of pellet.

Attributes	Commercial pellet (Control)	Formulation 1	Formulation 2	Formulation 3
Shape	6.60 ± 2.12^{bc}	5.83 ± 1.56^{ab}	5.40 ± 1.4^{a}	7.29 ± 1.64^{c}
Color	5.91 ± 1.78^{a}	6.49 ± 1.50^{ab}	5.71 ± 1.72^{a}	7.11 ± 1.45^{b}
Texture	6.09 ± 2.02^{ab}	6.23 ± 1.09^{b}	5.11 ± 1.76^{a}	6.69 ± 1.78^{b}
Fragile	6.43 ± 1.93^{a}	6.00 ± 1.46^{a}	5.77 ± 1.91^{a}	6.69 ± 1.91^{a}
Odor	5.14 ± 2.03^{a}	6.20 ± 1.75^{ab}	5.34 ± 1.63^{a}	6.74 ± 1.92^{b}
Overall acceptability	6.17 ± 1.85^{ab}	6.26 ± 1.29^{ab}	5.89 ± 1.51^{a}	7.17 ± 1.84^{b}

Based on hedonic test result for the shape attribute, showed that there was a significance difference between formulation 3 other than formulation 1 and 2. On the other hand, there was no significant different between formulation 3 and control which mean that the panelists evaluated that formulation 3 was better in shape compared to another formulation and it shape characteristic are similar to control.

For the color attribute, there was a significance difference between formulation 3 other than formulation 2 and control. However, there was no significant different between formulation 1 and 3 for the color attribute. It shown the panelists more prefer the color of greenery that come from pandan leaves other than the color of commercial pellet. The pellet produced can be colored, light, or bright. Animals, specifically rabbits, are unable to distinguish between colors in the same way that humans can, so multicolored pellet improve human vision and judgment (Razman et al., 2023).

While for the texture characteristics, there was no significant different between control compared to all three formulations. However, formulation 2 was significantly different to formulation 1 and 3. In pellet formulation, a good texture is essential. It is because, the pellet will be subjected to friction, impact, and pressure during storage and transport (Muramatsu et al., 2015).

Next, for the attribute of fragile, there was no significant different between control and all three formulations. It means all the three formulation was in the good their hardness in pellet forming. In general, pellet quality improves as particulate size decreases. This is because it is simpler to create denser pellets from powder (Razman et al., 2023).

On the other hand, there was significantly different for attribute odor between control and formulation 3. It means panelists more prefer formulation 3 other than the commercial pellet. The panelists prefer the odor of pandan leaves over the odor of commercial pellet, as shown by this finding.

For the attribute of overall acceptability, there was no significant different between control to formulation 1, 2 and 3. It means the developed formulation is almost similar to the commercial pellet in overall. However, the highest mean score for the attribute overall acceptability was formulation in score of 7.17 ± 1.84^{b}. This result is corroborated by the acceptability index (IA) of pellet as shown in Table 4. The highest IA is formulation 3 followed by formulation 1, control and formulation 2.

Table 4. Acceptability index (IA) of pellet.

Formulation	Acceptability index (IA) (%)
Commercial pellet (Control)	68.56
1	69.56
2	65.44
3	79.67

3.2 Percentage of Crumble Analysis

After the pellet forming, the residual particles were physically weighed, and the percentage of crumble were calculated. The percentage of crumble of a pellet measures the resistance to deterioration induced by fine grinding, machines capability, and transportations (Razman et al., 2023). Refer to the Table 5, the lowest percentage of crumble was formulation 3 which was 3.15 %. The percentage of crumble shows the fragility of the pellet. In the pellet production process, good pellet quality can be seen through a lower percentage of crumble.

Table 5. Percentage of crumble.

Analysis	Formulation 1	Formulation 2	Formulation 3
% Crumble	9.17	7.12	3.15

4. CONCLUSION

In conclusion, formulation 3 is the best formulation for formulation pandan pellets. This formulation satisfies all of the characteristics of panelists desired for rabbit pellets and is very similar to commercial pellets. It is suggested that future research compare the growth of rabbits feed pandan pellets to that of rabbits feed commercial pellets.

Acknowledgments: Mr Ahmad Rosali Paiman, chairman, Komuniti Penternak Arnab Pagoh, Pos 7B Kg Semaseh, Panchor, 84500 Muar, Johor

References

Fernandes, S. S., & Salas-Mellado, M. de las M. (2017). Addition of chia seed mucilage for reduction of fat content in bread and cakes. *Food Chemistry*, *227*, 237–244. https://doi.org/10.1016/j.foodchem.2017.01.075

Ghasemi, A., & Chayjan, R. A. (2019). Optimization of Pelleting and Infrared-Convection Drying Processes of Food and Agricultural Waste Using Response Surface Methodology (RSM). *Waste and Biomass Valorization*, *10*(6), 1711–1729. https://doi.org/10.1007/s12649-017-0178-5

Muramatsu, K., Dahlke, F., & Maiorka, A. (2015). Factors that Affect Pellet Quality: A Review. *Journal of Agricultural Science and Technology*, *5*, 717–722. https://doi.org/10.17265/2161-6256/2015.09.002

Ningrum, A., & Schreiner, M. (2014). Pandan leaves: "Vanilla of the East" as potential natural food ingredient. *Agro Food Industry Hi-Tech*, *25*(3), 10–14.

Razman, N. Q. F. M., Jamaluddin, N. S., & Halim, N. A. H. (2023). Rabbit Food Pellet Formulation from Sustainable Resources. *Multidisciplinary Applied Research and Innovation*, *4*(2), 186–191. https://doi.org/10.30880/mari.2023.04.02.025

Tistiana, H., Hartutik, Widodo, E., & Djunaidi, I. H. (2020). Effect of Pellet Size in Ration with or without Indigofera sp on New Zealand White Rabbit Performances. *IOP Conference Series: Earth and Environmental Science*, *478*(1). https://doi.org/10.1088/1755-1315/478/1/012048