Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

Biotechnology-Enhanced Poultry Feed: The Potential of Fermented Banana and Cassava Peels as Sustainable Ingredients

Hera Dwi Triani*), Gusri Yanti, Resolinda Harly, M.Amri

Faculty of Science, Social and Education, Prima Nusantara Bukittinggi University

*)Coresponding Author : heratriani@gmail.com

Abstrak:
The use of agricultural waste in poultry diets presents a sustainable solution to reduce feed costs and environmental waste. This study investigates the nutritional enhancement of banana peel flour (TKPF) and cassava peel flour (TKSF) through fermentation. The fermentation process significantly improved the crude protein content and metabolic energy of both by-products, with TKPF showing an increase in protein from 7.08% to 11.25% and metabolic energy from 2010 Kcal/kg to 3072.50 Kcal/kg. Similarly, TKSF exhibited a 30.56% increase in crude protein (from 11.84% to 15.46%) and a 68.5% increase in metabolic energy (from 1310 Kcal/kg to 2210 Kcal/kg). Both fermented products also demonstrated a reduction in crude fiber and anti-nutritional factors, making them more digestible and safer for poultry. The findings suggest that fermented banana and cassava peels can be used as cost-effective and environmentally friendly alternatives to traditional feed ingredients in poultry diets.

Keywords: Feed, Nutrition, Fermentation, Crude Protein, Crude Fiber

INTRODUCTION

The use of agricultural waste in animal feed has gained significant attention due to its potential to reduce feed costs and mitigate environmental issues caused by waste accumulation. Banana and cassava peels, as by-products of food processing, represent valuable feed materials if appropriately processed. These by-products contain high levels of fiber and antinutritional factors, which limit their direct utilization in poultry diets. However, fermentation has been identified as an effective method to enhance their nutritional quality and reduce harmful compounds (Adegbeye et al., 2020; Hassan et al., 2021).

Banana peels are rich in fiber and energy but have low protein content and high antinutritional factors, such as tannins and lignin, which reduce digestibility (Ahmed et al., 2020).

Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

Similarly, cassava peels contain cyanogenic glycosides, a toxic compound that can harm animal health if not properly processed (Iji et al., 2019). Fermentation not only reduces these antinutritional factors but also enhances protein content by introducing microbial activities that break down complex compounds into simpler, more digestible forms (Obinna-Echem and Chukwu, 2021).

Recent studies have highlighted the potential of fermented banana and cassava peels as alternative feed ingredients in poultry diets. Fermentation increases the crude protein content and metabolic energy of these by-products, making them suitable substitutes for conventional feed materials such as maize (Triani et al, 2024 ; Hassan et al., 2021). Moreover, the use of fermented agricultural waste supports sustainable livestock production by reducing dependency on traditional feed sources and promoting circular economy principles (Adegbeye et al., 2020).

This study aims to evaluate the nutritional improvement of fermented banana peel flour (TKPF) and fermented cassava peel flour (TKSF) and their potential application in poultry diets. The findings are expected to contribute to the development of cost-effective and environmentally friendly feed formulations.

RESEARCH METHOD

This research is a qualitative research by comparing descriptive analysis data.

Banana Peel Fermentation

The washed banana peels were cut into small pieces and then 3 treatments were carried out, namely fermentation with EM4 with doses (0 ml, 15 ml and 30 ml / 100 gr) with fermentation times (0, 6 and 12 days). This treatment aims to reduce the crude fiber content and improve the nutritional quality of the banana peel. After the banana peel is fermented, it is then dried in the sun to be made into Fermented Banana Peel Flour (TKPF). TKPF is analyzed for its nutritional content in the laboratory while to find Metabolic Energy (EM) it is carried out using the Sibbald method

Cassava Peel Fermentation

The processing of cassava peels carried out is soaking, drying, steaming to reduce the levels of cyanide acid (HCN) in the cassava peel and fermentation to increase the nutritional value of the cassava peel. The peel is cut into small pieces then soaked for 24 hours, after which the cassava peel is steamed. Next, the steamed cassava skin is fermented with tape yeast (dose 3g/kg for 8 days), after which it is dried and made into flour called Fermented Cassava Skin Flour

Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

(TKSF). TKSF is analyzed for its nutritional content in the laboratory while to find Metabolic Energy (EM) it is done using the Sibbald method.

RESULTS AND DISCUSSION

analyzing the nutritional content of Banana Peel Flour (TKP) with Fermented Banana Peel Flour (TKPF) Table 1.

Tabel 1. Kandungan Nutrisi dan Energi Metabolis TKPF dan TKP

Feed Ingridients	Crude protein(%)	Crude fat (%)	Crude Fiber(%)	Calcium (%)	Phosphorus (%)	Metabolizable Energy(Kkal/kg)
TKP	7.08	11.80	17.61	0.78	0.25	2010
TKPF	11.25	7.10	13.51	0.95	0.43	3072.50

Note : TKP= Banana Peel Meal, TKPF= Fermented Banana Peel Meal

Comparison of Nutrition and Antinutrients of TKS with TKSF

The content of Nutrition and Antinutrients (cyanic acid) of TKS and TKSF can be seen in Table 2. Table 2 shows that the fermentation treatment on cassava peels can increase nutrition, namely increasing crude protein and metabolic energy. In addition, fermentation treatment can also reduce the content of crude fiber and cyanic acid found in cassava peels

.Tabel 1. Kandungan Nutrisi dan Energi Metabolis TKPF dan TKP

Feed Ingridients	Crude protein(%)	Crude fat(%	Crude Fiber(%)	Calcium (%)	Phosphorus(%)	Metabolizable Energy(Kkal/kg)
TKS	11.84	11.80	21.96	0.48	0.25	1310
TKSF	15.46	5.85	9.49	0.89	0.64	2210

Note : TKS = Cassava Peel Meal, TKSK = Fermented Cassava Peel Meal

Nutritional Value of Fermented Banana Peel Flour (TKPF)

Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

The fermentation process significantly improved the nutritional quality of banana peel flour. Crude protein content increased from 7.08% (TKP) to 11.25% (TKPF), representing a 58.90% enhancement. Concurrently, crude fiber content decreased from 17.61% to 13.51%, marking a reduction of 23.27%. These results are consistent with studies by Adegbeye et al. (2020), which emphasize the role of fermentation in improving digestibility and breaking down fiber structures in unconventional feed materials.

Moreover, metabolic energy (ME) increased from 2010 Kcal/kg to 3072.50 Kcal/kg, highlighting improved energy availability post-fermentation. The reduction in crude fat (from 11.80% to 7.10%) aligns with findings by Hassan et al. (2021), who reported lipid degradation during fermentation, contributing to enhanced energy density. The fermentation also improved mineral content, as calcium (Ca) rose from 0.78% to 0.95% and phosphorus (P) from 0.25% to 0.43%, reflecting mineral bioavailability enhancement due to microbial activity.

Nutritional Value of Fermented Cassava Peel Flour (TKSF)

For cassava peel flour, fermentation resulted in a 30.56% increase in crude protein content, from 11.84% (TKS) to 15.46% (TKSF). Crude fiber content showed a significant reduction of 56.78%, from 21.96% to 9.49%. This reduction is attributed to microbial hydrolysis of fibrous compounds, as reported by Obinna-Echem and Chukwu (2021).

Additionally, ME increased from 1310 Kcal/kg to 2210 Kcal/kg, while crude fat content decreased from 11.80% to 5.85%. Minerals also showed improvement; calcium content rose from 0.48% to 0.89%, and phosphorus from 0.25% to 0.64%. The reduction of cyanogenic glycosides, a key antinutritional factor, underscores the effectiveness of soaking, steaming, and fermenting in neutralizing toxic compounds (Iji et al., 2019).

Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

Comparative Analysis of TKPF and TKSF

While both TKPF and TKSF demonstrated improved nutritional profiles post-fermentation, their attributes vary TKPF Exhibited higher ME (3072.50 Kcal/kg) compared to TKSF (2210 Kcal/kg), making it a superior energy source for poultry diets. TKSF Showed higher crude protein (15.46% vs. 11.25%), indicating its suitability as a protein-rich feed component. The reduction of antinutritional factors in TKSF, such as cyanogenic glycosides, further emphasizes its potential as a safe feed ingredient (Ahmed et al., 2020).

Implications for Poultry Feed Formulation

The results highlight the feasibility of incorporating fermented banana peel and cassava peel flours into poultry diets. These feed ingredients offer economic advantages by substituting traditional energy and protein sources such as maize. Moreover, the fermentation process not only enhances nutritional quality but also supports environmental sustainability by repurposing agricultural waste. Future research should focus on evaluating the direct effects of TKPF and TKSF inclusion on poultry performance metrics, such as growth rate, feed conversion ratio, and overall productivity.

Conclusion

Fermentation significantly improves the nutritional value of banana and cassava peels for poultry feed. Fermented banana peel flour (TKPF) provides higher energy, while fermented cassava peel flour (TKSF) offers superior protein content. Both ingredients reduce antinutritional factors, making them economical and sustainable alternatives to conventional feed. Further research is needed to assess their practical application in poultry diets.

REFERENCES

Adegbeye, M.J., Adeoye, S.A., Abioye, O., Kollath, D.R., 2020. Fermentation as a Tool for Enhancing Nutrient Availability in Agro-Waste for Livestock Feeding: A Review. J. Agric. Food Res. 2, 100049. https://doi.org/10.1016/j.jafr.2020.100049.

Vol 03 (02) Tahun 2024, Page 196-201
P- ISSN: 30248442
E-ISSN: 3025-3748
Available online at: http://ojs.ummy.ac.id/index.php/janaps

Ahmed, S., Rahman, M.H., Shamsuddin, Z.H., 2020. Reduction of Antinutritional Factors in Cassava-Based Feeds Through Biotechnological Interventions. Anim. Feed Sci. Technol. 259, 114297. https://doi.org/10.1016/j.anifeedsci.2020.114297.

Hassan, H.H., El-Sayed, M., Omar, H.M., 2021. Role of Microbial Fermentation in Enhancing the Nutritional Value of By-Products for Poultry Feed. Poult. Sci. 100, 1067–1078. https://doi.org/10.1016/j.psj.2020.10.015.

Iji, P.A., Khumalo, K., Slippers, S., Gous, R.M., 2019. Chemical Composition and Nutritive Value of Cassava Products for Poultry. World's Poult. Sci. J. 75, 556–567. https://doi.org/10.1017/S0043933919000060X.

Obinna-Echem, P.C., Chukwu, E.C., 2021. Bioprocessing Effects on Fiber Composition and Digestibility of Cassava and Plantain Peels in Poultry Nutrition. Heliyon 7, e06437. https://doi.org/10.1016/j.heliyon.2021.e06437.

Triani H.D., Yuniza A., Marlida Y., Husmaini, Astuti W.D., 2024. Evaluation of Metabolizable Energy and Crude Protein Balance on Productivity and Income on Male Kamang Ducks. J. Sain Pet. Ind. 19, 96-103, https://doi.org/10.31186/jspi.id.19.2.96-103.

Triani H.D., Marlida Y, Yuniza A, Husmaini, Astuti W.D., 2024. Isolation and characterization of cellulose and cyanide degrading bacteria from cassava waste as inoculants in feed fermentation. Int. J. Vet. Sci. 13, 384-390, https://doi.org/10.47278/journal.ijvs/2023.110.