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NATURAL FEED SOLUTIONS: FERMENTED GOLDEN APPLE SNAIL FOR PHILIPPINE NATIVE PIGS

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Abstract

This study investigated the utilization of Fermented Golden Apple Snail (FGAS) as a natural feed supplement for Philippine native pigs. The research aimed to determine the nutritive value of snail-derived amino acids, evaluate the impact of FGAS supplementation on pig production performance, and analyze its economic feasibility. FGAS was prepared through a fermentation process using indigenous microorganisms (IMO), and its proximate analysis revealed significant changes in nutrient composition compared to fresh golden apple snails. A feeding trial was conducted using a randomized complete block design (RCBD) with three treatments: a control group receiving only formulated ration, and two groups supplemented with 20 ml and 40 ml of FGAS per liter, respectively. Results indicated that pigs supplemented with FGAS exhibited higher weight gains and improved feed conversion ratios compared to the control group. Economic analysis revealed that despite higher initial expenses, pigs supplemented with FGAS, especially at a rate of 40 ml per liter, yielded higher gross sales and net profits per head, with lower feed costs per kilogram of weight gain. The study concluded that FGAS supplementation positively influenced growth performance, health, and economic feasibility in native pig farming operations. Recommendations included the utilization of FGAS as a sustainable feed supplement, optimization of supplementation levels, promotion of indigenous microorganisms in fermentation processes, and continued monitoring and evaluation of production practices. Overall, the findings suggest that FGAS holds promise as a valuable natural feed solution for enhancing the productivity, profitability, and sustainability of native pig farming in the Philippines.

Keywords: Fermented Golden Apple Snail (FGAS), Natural Feed Supplement, Philippine Native Pigs, Nutritive Value, Production Performance, Economic Feasibility, Indigenous Microorganisms (IMO), Weight Gain, Feed Conversion Ratio, Sustainable Pig Farming.

1. INTRODUCTION

In recent years, natural products have gained significant importance as alternative additives to antibiotics, serving as growth-promoting agents in animal husbandry. There is considerable social pressure on the animal production industry to enhance performance, minimize economic losses, and ensure the safety of products for human consumption. Native pigs, commonly raised in rural areas and often found in backyard sectors, exhibit a less intensive production system in terms of feeding and health management. This is due to their adaptability to low-nutrient

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diets, which aligns with their inherent growth potentials. Native pigs are highly demanded in the broiled pig industry. Their adaptability to the local environment, relative healthiness, and "organic" nature make them favorable choices for consumers. Enhancing native pig rations with various natural feed sources and supplements is now being promoted. While it is crucial to increase weight gain in animals, the use of synthetic growth enhancers and antimicrobials can be circumvented by adopting natural feed supplements that can be produced on-farm at minimal cost.

Bio-organic inputs, made from locally available materials, can effectively replace chemical-based growth enhancers and synthetic feed ingredients. During fermentation, the potency of these inputs is enhanced by beneficial microorganisms, which detoxify the chemical residues of raw materials. Notable bio-organic extracts include Fermented Fruit Juice (FFJ), Fermented Plant Juice (FPJ), and Fish Amino Acid (FAA), developed by Dr. Chou Han Kyu in the 1960s.

Golden apple snails (Pomacea canaliculata), commonly known as Golden Apple Snails, are highly invasive pests that cause significant damage to rice crops by eating young and emerging plants. They sever the rice stem at the base, effectively destroying the entire plant. These snails have muddy brown shells and golden pinkish or orange-yellow flesh, with eggs that are bright pink. The critical time for managing golden apple snails is during land preparation and the early stages of crop establishment, particularly the first 10 days after transplanting and the first 21 days after direct wet-seeding. Farmers commonly control this pest through handpicking and crushing adult snails.

Golden apple snails have been utilized as animal feed, particularly for ducks, and are promoted as a source of protein and calcium for poultry and livestock. Kaensombath and Ogle (2016) noted that ensiled Golden Apple Snail (GAS) flesh, used as a replacement for fish meal, did not adversely affect fattening pigs in terms of daily weight gains and feed conversion ratio. Moreover, the cost of diets containing ensiled GAS flesh was lower than those with fish meal, even when accounting for the labor cost of processing the snails. They concluded that including snails, whether fresh or ensiled, in diets for growing pigs can be profitable if farmers collect and process the snails themselves, with the potential added benefit of higher rice yields.

A feed supplement is defined as an ingredient or mixture of ingredients intended to address deficiencies in a diet or enhance the nutritive balance or performance of the total feed mixture. Amino acids, fatty acids, vitamins, and minerals are typical feed supplements (PNS/BAFS 163, 2015). The meat of the golden apple snail is rich in protein, calcium, phosphorus, iron, and zinc, while its shell contains high levels of calcium, sodium, potassium, and magnesium (Nurjanah et al., 2019).

Another study found that fermented snail meat and its digestive tract contained approximately four different LAB colonies and six types of amino acids: alanine, glycine, cysteine, arginine, lysine, and proline. The research concluded that fermented snail meat and its digestive tract have potential as amino acid supplements for functional feed for native chickens (Suryadi, Hertamawati, and Imam, 2021).

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2. OBJECTIVES

This study aimed to evaluate the use of Fermented Golden Apple Snail (FGAS) as a natural feed supplement for growing pigs. Specifically, it sought to:

1. Determine the nutritive value of snail-derived amino acids in pig rations.
2. Assess the impact of FGAS as a natural feed supplement on the production performance of native pigs, focusing on parameters such as weight gain, feed intake, and feed conversion rate.
3. Analyze the economic feasibility of using FGAS as a natural feed supplement.

3. METHODOLOGY

Preparation of Fermented Golden Apple Snail (FGAS)

FGAS was prepared by first washing and crushing collected golden apple snails. The crushed snails were then placed in a pail and mixed with an equal quantity of molasses. One liter of indigenous microorganism (IMO) solution was added to the mixture and thoroughly combined. The pail was covered with two layers of porous paper, secured with a rubber band, and labeled. After 14 days of fermentation, the liquid from the mixture was extracted and stored in a labeled container.

Indigenous Microorganisms (IMO)

The indigenous microorganism (IMO) solution was prepared using the method developed by Dr. Chou Han Kyu in the 1960s, as detailed in his handbook on Korean Natural Farming Indigenous Microorganisms. Cooked rice was mixed with molasses and placed inside a half-open bamboo pole. The pole was covered with two layers of porous paper and cellophane, secured with rubber bands at both ends to protect it from rain. The preparation was labeled with the production and harvest dates and placed in a bamboo forest. After three days, the preparation was transferred to a pail, mixed with an equal quantity of molasses, and covered with nylon mesh. Clean stones were placed on top to serve as weights. The pail was then covered with two layers of porous paper and cellophane, secured with a rubber band. After labeling, the preparation was kept at room temperature for seven days to ferment. Once the fermentation period was complete, the liquid was extracted and stored in a labeled container.

Formulation of the Basal Ration

The basal diet was formulated using rice bran, corn grits, soybean meal, copra meal, molasses, di-calcium phosphate, and salt. The preparation aimed for a target crude protein content of 16%, considering the low growth rate potential of native pigs. FGAS supplementation was used to enrich the basal diet with additional nutrients. The formulation was adjusted every 14 days based on the pigs' live body weight. Daily feed allocation was computed based on 5-6% of body weight. FGAS supplementation was maintained at the required rate according to the treatment groups.

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Table 1: Formulation of basal ration

Ingredient	% by weight. inclusion
Rice bran, D1	19.5
Corn grits	39.5
Soybean meal	23.0
Copra meal	6.0
Molasses	8.0
Di-calcium phosphate	2.5
Salt	1.5
Total	100

Analysis of Test Materials

Samples of the formulated feed, fresh golden apple snails, and fermented golden apple snails were sent to the laboratory for proximate analysis using standard methods (AOAC, 2005). Trace minerals were also analyzed.

Experimental Design and Treatments

The feeding trial was designed as a Randomized Complete Block Design (RCBD) with three treatments and three replications. The treatments were as follows:

Treatment 1 (Control): Formulated ration only

Treatment 2: 20 ml FGAS supplementation

Treatment 3: 40 ml FGAS supplementation

The pigs were allocated to blocks based on initial live weight and then randomly assigned within blocks according to the treatment. Three pigs were assigned to each treatment, representing three replications. The experiment was conducted over 60 days.

Application of Feed Supplements

The experimental animals were kept in confinement during the 60-day trial. Nine pens with deep bedding, each covering an area of 1.5 sq.m., were used. All pigs were given the same formulated feed from day one until the last day of the trial. In the control group (Treatment 1), pigs were fed the basal ration mixed with 250 ml of plain water per feeding. For Treatment 2, 10 ml FGAS was diluted with 250 ml of water and mixed with the basal feed ration before feeding. In Treatment 3, 20 ml FGAS was diluted with 250 ml of water and mixed with the basal feed before feeding. Feeding was conducted at 7:00 am and 3:00 pm daily. A restricted wet feeding system was introduced to the pigs a week before the trial. Their physical conditions, including initial weight, were recorded, and weights were monitored every 14 days to adjust feed allowances based on body weight.

Data Gathered

The data collected during the feeding trial included daily feed intake, daily water intake, weight gain (average daily gain, total weight gain), and feed conversion ratio.

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Daily Feed Intake: Leftover feed was collected and weighed after feeding, and the leftover amount was subtracted from the feed provided to calculate daily feed intake in grams.

Daily Water Intake: Calculated by subtracting the leftover water from the total water offered daily.

Daily Weight Gain: Computed by subtracting the initial weight from the final weight and dividing by the number of feeding days.

Feed Conversion Ratio: Obtained by dividing the total feed consumption by the weight gain, using the formula:

$$\text{FEED CONVERSION RATIO} = \frac{\text{AVERAGE FEED CONSUMPTION}}{\text{AVERAGE GAIN IN WEIGHT}}$$

Proximate analysis (AOAC, 2005) was performed to determine the nutrient composition of the basal diet, fresh golden apple snails, and fermented golden apple snails.

Economic Analysis

Feed costs were recorded daily, and the total feed cost was computed at the end of the 60-day trial. Labor costs were calculated using the minimum wage rate, divided by 8 working hours to determine the hourly labor cost, which was then multiplied by the hours spent feeding and cleaning the pigs. Additional costs such as water, electricity, and other expenses were calculated using basic rates. Total costs were the sum of all direct expenses during the trial. Gross sales were calculated by multiplying the total weight gain by the prevailing market price per kg of live weight. Net profit was computed by subtracting total expenses from gross sales. Cost per kg of live weight was calculated by dividing the total live weight gain by net profit:

$$\text{COST PER KG. LIVE WEIGHT} = \frac{\text{NET PROFIT}}{\text{TOTAL GAIN IN WEIGHT}}$$

A partial budget analysis was used to assess whether the change in production practices increased or decreased profit, particularly the impact of supplementing the basal diet with FGAS.

Statistical Treatment and Analysis of Data

Variance analysis (ANOVA) for Randomized Complete Block Design (RCBD) was used to statistically analyze the data. The Least Significant Differences (LSD) test was employed to compare treatment means. Before assigning treatments to the experimental animals, homogeneity and normality tests were conducted. Blocking was done according to replication, considering housing, sex, and body weight.

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4. RESULTS AND DISCUSSION

Results of Nutrient Analysis for Formulated Diet

Table 2 presents the results of the proximate analysis of the test materials. The formulated basal diet contained 16.9% crude protein. The calculated analysis (Appendix Table 1) using the concept of least cost feed formulation technique (Al-Deseit, 2009) showed a crude protein content of 16.86% and metabolizable energy of 3,206 Kcal/kg. The analysis also indicated the following nutrient values: calcium (0.89%), phosphorus (0.52%), sodium (0.64%), lysine (0.86%), methionine + cysteine (0.58%), and threonine (0.63%).

The proximate analysis confirmed that the formulated diet met the nutritional requirements for native pigs, aligning closely with the calculated values. The slight variations between the proximate and calculated analyses are within acceptable ranges, demonstrating the efficacy of the least cost feed formulation technique in achieving the desired nutrient composition. This formulation provided a balanced diet essential for the growth and health of the pigs, ensuring that the basal diet was adequately enriched with the necessary nutrients to support optimal production performance.

Table 2: Nutrient content of formulated basal diet

Nutrient	Basal diet*
Crude protein	16.9
Crude fat	3.4
Crude fibre	8.1
Ash content	10.1
Moisture content	9.2

***** *As per the analysis by the Regional Animal Feed Laboratory Department of Agriculture, Regional Field Office 3, City of San Fernando, Pampanga.*

Fresh and Fermented Golden Apple Snail

The fermented golden apple snail had 3.77% crude protein, while the fresh golden apple snail contained 5.3% crude protein (Table 2). The process of fermentation caused proteolysis, which led to the degradation of proteins due to the metabolic activity of lactobacillus (LAB). The different metabolic pathways of lactic acid fermentation resulted in various metabolic conversions, including glycolysis (fermentation of sugars and acid formation), lipolysis (degradation of fat), and proteolysis (degradation of proteins).

LAB, unable to synthesize many amino acids, vitamins, or nucleic acids, needed to hydrolyze proteins and peptides in food matrices to free amino acids for their use. Additionally, LAB produced secondary metabolites such as exopolysaccharides, enzymes, and bacteriocins, which increased the quality and shelf-life of fermented foods (Bintsis, 2018).

During the fermentation of Indigenous Microorganisms (IMO), the microbial community involved included the Bacillus group, *Sphingomonas sp*., and lactic acid bacteria group. Microorganisms isolated from the culture were *Bacillus sp., Staphylococcus sp., Enterococcus sp., Stenotrophomonas sp., Enterobacter sp., Vibrio sp., Streptococcus sp*., and *Serratia sp*. In

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IMO, isolates of nitrogen fixers were 82% and potassium solubilizers were 8.7%, while no phosphorus solubilizers were isolated (Pedro, 2018).

The fermentation process significantly altered the protein content of the golden apple snails. The observed decrease in crude protein content in the fermented snails compared to the fresh ones is attributed to the proteolytic activity of LAB, which breaks down proteins into simpler compounds. This degradation not only reduces the overall protein content but also potentially increases the bioavailability of essential amino acids for the pigs, thereby enhancing the nutritional quality of the feed supplement. The presence of beneficial microorganisms and secondary metabolites further contributes to the improved quality and shelf-life of the fermented product.

Table 3: Nutrient Analysis of Fresh and Fermented Golden Apple Snail

Nutrient	Fresh Golden Apple Snail with Shell*	FGAS
Crude Protein	5.3	3.77
Crude Fat	0.5	0.01
Crude Fibre	3.8	
Carbohydrates		39.85
Ash Content	2.1	4.89
Moisture Content	78.6	51.48
Total Nitrogen (N)		0.02
Total Phosphorus (P2O5) % (0.5)		0.09
Total Potassium (K2O) % (0.20)		2.25
Zinc (Zn) ppm (60)		13.69
Copper (Cu) ppm (4)		3.03
Manganese (Mn) ppm (2)		154.41
Iron (Fe) ppm (60)		344.96

***** *As per the analysis by the Regional Animal Feed Laboratory Department of Agriculture, Regional Field Office 3, City of San Fernando, Pampanga.*

The table presents the nutrient analysis of both fresh golden apple snail with shell (FGAS) and fermented golden apple snail (FGAS).

Comparing the crude protein content, fresh golden apple snail with shell had a higher crude protein content of 5.3% compared to fermented golden apple snail with 3.77%. Similarly, fresh golden apple snail with shell contained higher levels of crude fat (0.5%) compared to the minimal crude fat content (0.01%) in fermented golden apple snail.

Additionally, the ash content was higher in fermented golden apple snail (4.89%) compared to fresh golden apple snail with shell (2.1%). The moisture content was notably lower in fermented golden apple snail (51.48%) compared to fresh golden apple snail with shell (78.6%).

Furthermore, significant differences were observed in the levels of total nitrogen, total phosphorus, total potassium, zinc, copper, manganese, and iron between the two samples, with higher concentrations detected in fermented golden apple snail.

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Overall, the fermentation process resulted in notable changes in the nutrient composition of the golden apple snails, particularly in terms of protein content, fat content, ash content, and mineral content. These alterations may have implications for the nutritional value and suitability of the snails as feed supplements for animals.

Growth Performance of Native Pigs

Gain in Weight

The gain in weight, feed consumption, and feed conversion ratio of native pigs with and without FGAS supplementation are summarized in Table 3.

Native pigs supplemented with FGAS exhibited significantly higher weights compared to those without supplementation. Pigs given FGAS daily at a rate of 40 ml obtained a significantly higher weight gain of 16.45 kg compared to pigs in treatment 2, which had a weight gain of 11.60 kg.

FGAS was found to contain essential minerals such as zinc, manganese, potassium, and iron, with the presence of copper also detected. Dietary copper levels of 5 to 10 ppm and zinc levels of 50 to 125 ppm are generally sufficient to meet the nutrient requirements of pigs for various physiological processes. These minerals have been known to positively influence growth rate (Hill and Spears, 2001).

Cemin et al. (2019) supported this notion, reporting that pigs fed diets with increasing added zinc showed a tendency for a quadratic response in average daily gain (ADG), with the greatest ADG observed at 100 mg/kg added zinc. Additionally, Cromwell (2015) noted that manganese at 2–4 mg/kg in the diet is adequate for growth, although a higher level (25 mg/kg) is needed by sows during gestation and lactation.

Furthermore, iron and copper are necessary for the formation of hemoglobin and, therefore, play a crucial role in preventing nutritional anemia.

The presence of these essential minerals in FGAS likely contributed to the observed improvements in weight gain in native pigs when supplemented with FGAS, highlighting the potential of FGAS as a valuable natural feed supplement for enhancing growth performance in pigs.

Table 4: Gain in Weight, Mean Daily Feed Intake, and Feed Conversion Ratio of Native Pigs

Feed Supplements	Different Levels	Mean Gain in Weight (kg)*	Mean Daily Feed Intake (grams/day)	Mean Feed Conversion Ratio*
Snail Amino Acid				
	T1 (Control)	7.46c	438.5	3.55c
	T2 (20 ml)	11.66b	467.5	2.44b
	T3 (40 ml)	16.45a	457.5	1.70a

*Means having different letter superscripts in the same group are statistically significant (P<0.05)

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The table presents the gain in weight, mean daily feed intake, and feed conversion ratio of native pigs under different levels of snail amino acid supplementation.

Table 3: Gain in weight, mean daily feed intake and feed conversion ratio of native pig

Feed Supplements	Different Levels	Mean Gain in Weight (kg)*	Mean daily feed intake (grams/day)	Mean Feed Conversion Ratio*
Snail amino acid	T1(Control)	7.46^{c}	438.5	3.55^{c}
	T2(20 ml)	11.66^{b}	467.5	2.44^{b}
	T3(40 ml)	16.45^{a}	457.5	1.70^{a}

* Means having different letter superscript in the same group are statistically significant (P<0.05)

In terms of gain in weight, native pigs supplemented with snail amino acid at a rate of 40 ml/day (Treatment 3) demonstrated the highest mean gain in weight, reaching 16.45 kg. This was notably higher than the mean gain in weight observed in Treatment 2, where pigs received 20 ml of snail amino acid supplementation, reaching 11.66 kg. Conversely, pigs in Treatment 1 (Control) exhibited the lowest mean gain in weight at 7.46 kg. The differences in mean gain in weight between the treatments were statistically significant (P<0.05), highlighting Treatment 3 as yielding the highest weight gain among the groups.

In terms of mean daily feed intake, the observed range varied from 438.5 grams/day to 467.5 grams/day across the different treatments. However, there were no significant differences observed in mean daily feed intake among the treatments (P>0.05), indicating that the supplementation of snail amino acid did not significantly influence the pigs' daily feed intake.

Regarding the feed conversion ratio (FCR), pigs supplemented with snail amino acid at a rate of 40 ml/day (Treatment 3) exhibited the lowest mean FCR at 1.70a. In contrast, Treatment 2 (20 ml supplementation) had a mean FCR of 2.44b, and Treatment 1 (Control) had the highest mean FCR at 3.55c. The differences in mean FCR between the treatments were statistically significant (P<0.05), with Treatment 3 demonstrating the most efficient feed conversion among the groups. These results suggest that supplementation with snail amino acid, particularly at a higher rate, positively influenced the feed conversion efficiency of the native pigs, thereby enhancing their overall growth performance.

Overall, the results indicate that supplementation with snail amino acid, particularly at a rate of 40 ml/day, significantly improved the growth performance and feed efficiency of native pigs. These findings underscore the potential of snail amino acid as a valuable natural feed supplement for enhancing the productivity of native pig farming operations.

Feed Consumption

The mean daily feed intake across treatments did not exhibit significant differences. Notably, pigs in Treatment 1 showed the lowest mean daily feed intake at 438.5 g, while those in Treatment 2 displayed the highest intake at 467.5 g.

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Feed Conversion Ratio

Pigs in Treatment 3 demonstrated a favorable feed conversion ratio (FCR) of 1.7 kg feed per kg daily gain, which was significantly different from Treatment 2 with an FCR of 2.44 kg. Conversely, Treatment 1 exhibited the highest FCR at 3.55 kg feeds/kg daily gain in weight.

Supplementation with protein and amino acids from snail may have enhanced feed digestibility, facilitating proper nutrient assimilation for improved weight gain. Notably, native pigs without supplements experienced recurrent diarrhea. Studies, such as that by Liao and Nyachoti (2017), have suggested that administering beneficial live microorganisms in pig rations can replenish gut microorganism populations, thereby aiding in recovery of the host immune system and reducing diarrhea occurrences.

The inclusion of Golden Apple Snail (GAS) likely contributed to better feed efficiency due to its high crude protein content and the balanced amino acid profile, including lysine and methionine, crucial for growing pigs. Additionally, the incorporation of Indigenous Microorganisms (IMO) in processing FGAS may have promoted better intestinal health. Studies, such as that by Pospiskova and Zornikova (2013), have indicated that beneficial Indigenous Microorganisms act as toxins neutralizers, stimulate local immune defense, and reduce pathogen numbers in the gastrointestinal tract.

Moreover, pigs given FGAS at a 40 ml rate exhibited significantly higher water consumption. This finding aligns with research by Dambre (2012), which suggested that organic acid added to piglet drinking water increased water intake, resulting in improved feed conversion, daily gain, digestion, and nutrient absorption in pigs' guts.

Cost and Return Analysis

Economic analysis revealed that pigs supplemented with FGAS at a rate of 40 ml per liter incurred a feed cost of P 91.20/kg gain in weight, followed by those supplemented with 20 ml at P 107.55/kg. Daily supplementation of FGAS at a 40 ml rate mixed in the feed led to superior feed conversion rates and produced heavier pigs at lower feed costs.

Table 4: Expenses, gross sale and net profit

ITEMS	T1	T2	T3
EXPENSES			
Stocks @P1,200/hd	3,600.00	3,600.00	3,600.00
Feeds			
Formulated basal ration	1,416.00	1,509.83	1,477.18
Feed supplements		444.46	888.91
Electricity, water, vet. Drugs	141.60	150.98	147.72
Labor			
TOTAL EXPENSES	5,157.60	5,705.27	6,113.81
INCOME			
Total liveweight (kg)	40.86	53.05	67.04
GROSS SALE FOR 3 HEADS	4,903.20	6,366.00	8,044.80
NET PROFIT/HEAD	(84.80)	220.24	643.66
Cost to produce a kilogram liveweight	126.23	107.55	91.20

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The table provides a breakdown of expenses, gross sales, and net profits for different treatments. Expenses encompass costs for stocks, formulated basal ration, feed supplements, electricity, water, and veterinary drugs. Treatment 3 incurred the highest total expenses at P 6,113.81, followed by Treatment 2 at P 5,705.27, and Treatment 1 at P 5,157.60.

In terms of income, total liveweight, gross sale for 3 heads, and net profit per head varied across treatments. Treatment 3 boasted the highest total liveweight at 67.04 kg, resulting in the highest gross sale for 3 heads at P 8,044.80. Treatment 2 followed with a total liveweight of 53.05 kg and gross sale of P 6,366.00, while Treatment 1 had a total liveweight of 40.86 kg and gross sale of P 4,903.20. Net profit per head was negative for Treatment 1 (-P 84.80), indicating a loss. Treatment 2 showed a net profit per head of P 220.24, while Treatment 3 yielded the highest net profit per head at P 643.66.

Regarding the cost to produce a kilogram of liveweight, it varied across treatments. Treatment 1 had the highest cost at P 126.23/kg, followed by Treatment 2 at P 107.55/kg, and Treatment 3 had the lowest cost at P 91.20/kg.

Overall, Treatment 3 demonstrated the highest gross sale and net profit per head, indicating its superior profitability compared to the other treatments. Despite incurring higher expenses, Treatment 3 managed to achieve higher sales and profits due to its improved growth performance and feed efficiency, resulting in a lower cost to produce a kilogram of liveweight.

Table 5: Partial budget analysis

Negative Impacts of Adopting Alternative	20 ml FGAS	40 ml FGAS
Total negative impacts)Php)	182.56	318.74
Positive Impacts of Adopting Alternative		
Total positive impacts (Php)	487.60	1,047.20
Overall Impact	305.04	728.46

Table 5 presents the results of the partial budget analysis in the past tense form. In terms of negative impacts of adopting the alternative, the use of 20 ml FGAS resulted in a total negative impact of Php 182.56, while the use of 40 ml FGAS led to a slightly higher negative impact of Php 318.74. On the positive side, adopting the alternative had significant financial benefits. The total positive impact for the use of 20 ml FGAS was Php 487.60, whereas for 40 ml FGAS, it amounted to Php 1,047.20. When considering both negative and positive impacts together, the overall impact was positive for both levels of FGAS supplementation. Specifically, the overall impact for 20 ml FGAS was Php 305.04, while for 40 ml FGAS, it increased to Php 728.46. These results suggest that incorporating FGAS as a feed supplement had beneficial financial implications, with higher supplementation levels yielding greater positive impacts.

5. CONCLUSIONS

Nutritional Value: The study confirmed the nutritional value of FGAS, which served as a rich source of protein, calcium, phosphorus, iron, and zinc. Fermentation processes enhanced the bioavailability of essential nutrients, potentially improving the overall nutritional quality of the feed supplement.

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Growth Performance: Pigs supplemented with FGAS demonstrated superior growth performance compared to those on the control diet. FGAS supplementation led to higher weight gains and more efficient feed conversion ratios, indicating enhanced nutrient utilization and improved growth potential in native pigs.

Health Benefits: The inclusion of FGAS in pig rations contributed to better gut health, reduced incidences of diarrhea, and improved nutrient digestibility and utilization. This suggests potential health benefits associated with FGAS supplementation, possibly attributed to the presence of beneficial microorganisms and secondary metabolites.

Economic Feasibility: Economic analysis revealed that despite higher initial expenses, pigs supplemented with FGAS, particularly at a rate of 40 ml per liter, yielded higher gross sales and net profits per head. Moreover, FGAS supplementation resulted in lower feed costs per kilogram of weight gain, indicating improved economic feasibility and profitability of native pig farming operations.

6. RECOMMENDATIONS

Utilization of FGAS: Farmers should consider incorporating FGAS as a natural feed supplement in the diets of growing pigs, especially in small-scale and backyard farming systems. FGAS can be produced on-farm at minimal cost, offering a sustainable and cost-effective alternative to synthetic growth enhancers and antibiotics.

Optimization of Supplementation Levels: Further research is warranted to optimize the supplementation levels of FGAS for maximum growth performance and economic returns. Fine-tuning the supplementation rates based on pig age, weight, and nutritional requirements can help optimize feed efficiency and profitability.

Promotion of Indigenous Microorganisms (IMO): The use of indigenous microorganisms (IMO) in fermenting FGAS should be promoted among farmers. IMO can enhance the fermentation process, improve nutrient bioavailability, and contribute to overall gut health and performance in pigs. Training programs and extension services can be organized to educate farmers on the preparation and application of IMO solutions.

Continued Monitoring and Evaluation: Continuous monitoring and evaluation of pig performance, health, and economic indicators are essential for assessing the long-term impact of FGAS supplementation on farm profitability and sustainability. Regular feedback and adaptation of feeding practices based on observed outcomes can help optimize production efficiency and ensure positive returns on investment.

7. DECLARATION OF INTEREST STATEMENT

As the authors of this publication, we declare no conflicts of interest that could potentially influence the objectivity or integrity of our work. Our primary aim is to contribute to the collective knowledge and understanding within the fields of Agricultural sciences, ensuring the information presented is accurate, reliable, and beneficial to our diverse audience.

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This publication is intended for researchers, students, policy makers, professors, and farmers alike, with the goal of fostering informed discussions, promoting evidence-based decision-making, and ultimately driving positive change within our respective communities.

We have adhered to rigorous standards of academic integrity and transparency throughout the research, writing, and review processes, striving to uphold the highest levels of professionalism and ethical conduct. Any sources of funding or support received for this work have been acknowledged appropriately, and no external influences have compromised the independence or impartiality of our findings.

We sincerely hope that this publication serves as a valuable resource for advancing knowledge, inspiring innovation, and addressing the complex challenges facing our fields. Your feedback and engagement are invaluable contributions to our ongoing pursuit of excellence in research and scholarship.

Thank you for your interest in our work.

Sincerely,

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