

**EFFECT OF SEAWEED BRAN-BASED CONCENTRATE (*GRACILARIA* SP.)
SUPPLEMENTATION ON THE GROWTH OF LANDRACE PIGS IN FARMS AT
SANDING VILLAGE, GIANYAR REGENCY**

**Pengaruh Pemberian Konsentrat Berbasis Dedak Rumput Laut (*Gracilaria* sp.)
Terhadap Pertumbuhan Babi Landrace di Peternakan Desa Sanding Gianyar**

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Abstract

Landrace pigs are one of the livestock commodities that produce animal protein and are widely raised in Bali because of their rapid growth rate. Efforts to improve livestock growth can be achieved by improving feed quality using alternative feed ingredients, such as *Gracilaria* sp. seaweed, which contains important bioactive compounds and nutrients. This study aimed to determine the effect of *Gracilaria* sp.-based seaweed bran concentrate supplementation on the growth of landrace pigs on farms located in Sanding Village, Gianyar Regency. This study used an experimental method with a completely randomized design (CRD) consisting of two groups, namely a control group without concentrate supplementation and a treatment group supplemented with 1 kg of seaweed bran-based concentrate. The formulated concentrate contained 69.7% *Gracilaria* sp. seaweed bran per kg of feed mixture. A total of 32 male landrace pigs, aged approximately $\pm$ 2 months, were maintained for three months. The observed parameters included chest circumference, body length, and body weight, and the data were analyzed using an independent sample t-test with IBM SPSS Statistics (version 26). The results showed that the treatment group had higher

average chest circumference (109.05 ± 0.32 cm), body length (112.21 ± 0.30 cm), and body weight (95.31 ± 0.70 kg) than the control group. Statistical analysis indicated a significant difference ($P < 0.05$) between the two groups. In conclusion, supplementation with the seaweed bran-based concentrate *Gracilaria* sp. significantly improved the growth of landrace pigs and has the potential to be an effective and economical alternative feed supplement. Further studies are recommended to determine the optimal dosage and long-term effects of seaweed supplementation on livestock production.

Keywords: Alternative feed, *Gracilaria* sp, Growth, Landrace pigs, Seaweed bran concentrate

Abstrak

Babi landrace merupakan salah satu ternak penghasil protein hewani yang memiliki pertumbuhan cepat dan banyak dipelihara oleh masyarakat di Bali. Upaya peningkatan pertumbuhan ternak dapat dilakukan melalui perbaikan kualitas pakan dengan memanfaatkan bahan pakan alternatif seperti rumput laut *Gracilaria* sp. yang mengandung senyawa bioaktif dan nutrisi penting. Penelitian ini bertujuan untuk mengetahui pengaruh pemberian konsentrat berbasis dedak rumput laut *Gracilaria* sp. terhadap pertumbuhan babi landrace di peternakan Desa Sanding, Kabupaten Gianyar. Penelitian ini menggunakan metode eksperimental dengan Rancangan Acak Lengkap (RAL) yang terdiri atas dua kelompok, yaitu kelompok kontrol tanpa pemberian konsentrat dan kelompok perlakuan dengan tambahan konsentrat berbasis dedak rumput laut sebanyak 1 kg. Konsentrat yang diformulasikan mengandung dedak rumput laut *Gracilaria* sp. sebanyak 69,7% per kg campuran pakan. Penelitian menggunakan 32 ekor babi landrace jantan umur ± 2 bulan yang dipelihara selama 3 bulan. Parameter yang diamati meliputi lingkar dada, panjang badan, dan berat badan, kemudian data dianalisis menggunakan uji independent sample t-test dengan IBM SPSS Statistics versi 26. Hasil penelitian menunjukkan bahwa kelompok perlakuan memiliki rata-rata lingkar dada $109,05 \pm 0,32$ cm, panjang badan $112,21 \pm 0,30$ cm, dan berat badan $95,31 \pm 0,70$ kg, lebih tinggi dibandingkan kelompok kontrol. Hasil uji statistik menunjukkan adanya perbedaan nyata ($P < 0,05$) antara kedua kelompok. Berdasarkan hasil penelitian dapat disimpulkan bahwa pemberian konsentrat berbasis dedak rumput laut *Gracilaria* sp. berpengaruh signifikan terhadap pertumbuhan babi landrace dan berpotensi menjadi alternatif pakan tambahan yang efektif dan ekonomis. Disarankan dilakukan penelitian lanjutan mengenai dosis optimal dan pengaruh jangka panjang penggunaan dedak rumput laut terhadap performa produksi ternak.

Kata kunci: Babi landrace, *Gracilaria* sp, Konsentrat dedak rumput laut, Pakan alternatif, Pertumbuhan

INTRODUCTION

Landrace pigs are a major source of animal protein and play a vital role in meeting the food needs of the population, particularly in Bali. These pigs are widely raised by farmers because of their rapid growth rate, good feed conversion efficiency, and high-quality meat (Syahputra et al., 2025). Improvements in pig productivity are significantly influenced by genetic factors, environment, management practices, and feed quality. Feed is a key factor in supporting growth, as approximately 60–80% of the production costs in the swine industry stem from feed procurement (Bana et al., 2018). Therefore, innovations in the use of alternative feed ingredients that are highly nutritious, readily available, and cost-effective are needed to support optimal livestock growth.

One alternative feed ingredient with potential for use is the seaweed *Gracilaria* sp., which contains various bioactive compounds, minerals, vitamins, and polysaccharides that are beneficial for livestock health and growth (Ghazali et al., 2025). The fiber and bioactive compounds in seaweed improve digestive tract health and nutrient absorption efficiency, thereby supporting livestock growth (Corino et al., 2021). Furthermore, the use of seaweed as a feed additive has the potential to reduce dependence on commercial feed and lower livestock production costs, as Indonesia is one of the world's largest seaweed producers (Syam et al., 2020).

Given the potential nutritional content and bioactive compounds found in *Gracilaria* sp. seaweed, scientific research is needed to determine the effectiveness of its use as a feed additive on the growth performance of pigs. Previous research has shown that supplementing feed with seaweed can improve nutrient utilization efficiency and livestock growth by enhancing gastrointestinal health and increasing feed digestibility (Moraes et al., 2020). Therefore, this study was conducted to evaluate the effect of feeding a concentrate based on *Gracilaria* sp. seaweed bran on the growth of Landrace pigs at a farm in Sanding Village, Gianyar Regency, Indonesia. The growth parameters observed included chest circumference, body length, and body weight, which were used as indicators of livestock growth. The results of this study are expected to provide scientific information on the use of seaweed bran as an effective, economical, and sustainable alternative feed to support pig productivity.

RESEARCH METHODS

Ethical Approval for Laboratory Animals

All procedures involving the use of laboratory animals in this study were approved by the Animal Ethics Committee of the Faculty of Veterinary Medicine, Udayana University, under Animal Ethics Approval Letter No. B/50/UN14.2.9/PT.01.04/2026. This study focused on the growth of Landrace pigs and was published as part of a collaborative research umbrella project.

Research Subjects

The research subjects were male Landrace pigs aged approximately 2 months, weighing approximately 20 kg, which were raised for 3 months at a farm in Sanding Village, Gianyar, Bali, Indonesia.

Research Design

This experimental study used a quantitative approach with a completely randomized design (CRD) with two treatment groups: a control group fed a traditional diet without the addition of *Gracilaria* sp. seaweed bran concentrate and a treatment group fed a diet supplemented with *Gracilaria* sp. seaweed bran concentrate. After three months of treatment, the pigs' body weights were measured once a month for three months to assess the effect of seaweed bran concentrate supplementation on the growth of the pigs.

Research Variables

The independent variable in this study was the administration of a concentrate made from *Gracilaria* sp. seaweed bran at a dose of 1 kg/animal/day. The treatment feed was administered twice daily (0.5 kg per feeding) as a homogeneous mixture consisting of 0.5 kg traditional feed and 0.5 kg of the formulated concentrate. The details of the standard formulation and nutrient content of the 1 kg dose of the treatment concentrate are presented in Table 1.

Data Collection Methods

Research data were obtained through experimental methods and direct observations of Landrace pig growth during the rearing period. A total of 32 male Landrace pigs aged ± 2 months were divided into two groups: a control group without concentrate and a treatment group fed a concentrate based on *Gracilaria* sp. seaweed bran at a rate of 1 kg/day/pig, administered consistently through a twice-daily feeding schedule: 0.5 kg in the morning and 0.5 kg in the afternoon. Each 0.5-kg portion of the concentrate was homogeneously mixed with traditional wet feed (chopped banana stems, taro leaves, and jackfruit) in a feed bucket before being poured into the feed troughs of each pen in the treatment group. The rearing period lasted for 3 months under standardized pen conditions, basal feed, and management practices to minimize the influence of external factors (Bana et al., 2018). The data collection involved measuring the chest circumference, body length, and body weight. Chest circumference was measured at the thoracic region behind the scapula, and body length was measured from the tuberculum humeri to the tuber ischii (Figure 1).

Body weight was calculated using the Schoorl formula: $BB = (LD^2 \times PB)/10,000$, where BB = body weight (kg), LD = chest circumference (cm), and PB = body length (cm). The value of 10,000 in the formula represents the empirical specific gravity constant of pig carcasses. All morphometric data collected from the control group (without concentrate supplementation) and treatment group (with a concentrate dose of 1 kg/day/animal divided into two feedings) were tabulated for further statistical analysis using an independent samples t-test.

Data Analysis

The data were analyzed using IBM SPSS Statistics Version 26. Body length, chest circumference, and body weight were analyzed using independent sample t-tests. This test was used to compare the means between two independent groups: the treatment group (fed a diet supplemented with *Gracilaria* sp. seaweed bran concentrate) and the control group (fed a diet without *Gracilaria* sp. seaweed bran).

RESULTS AND DISCUSSION

Results

The results of the present study indicate that the administration of a seaweed (*Gracilaria* sp.) bran-based concentrate affected the growth of Landrace pigs, as observed through the parameters of chest circumference, body length, and body weight (Table 2). Based on Table 3 and Figure 1, the treatment group fed the *Gracilaria* sp. seaweed bran-based concentrate showed higher average chest circumference, body length, and body weight than the control group. The average chest circumference in the treatment groups was 109.05 ± 0.32 cm, body length 112.21 ± 0.30 cm, and body weight 95.31 ± 0.70 kg, while in the control group, these values were 91.90 ± 0.40 cm, 99.15 ± 0.47 cm, and 59.82 ± 0.46 kg, respectively. The independent samples t-test analysis indicated a significant difference ($P < 0.05$) between the control and treatment groups for all growth parameters. These results indicate that the administration of a concentrate based on *Gracilaria* sp. seaweed bran significantly affects the growth of Landrace pigs.

Discussion

The results of the statistical analysis using an independent samples t-test showed that substituting conventional feed bran with a concentrate based on *Gracilaria* sp. seaweed bran had a significantly different effect ($P < 0.05$) on all physical performance parameters of Landrace pigs in the growing phase at the farm in Sanding Village, Gianyar (Table 3). The

group of pigs that received the seaweed bran concentrate supplement (P1) achieved an average final body weight of 95.31 ± 0.70 kg, significantly exceeding that of the control group (P0), which reached only 59.82 ± 0.46 kg at the end of the third month of rearing. The substantial increase in body weight in this treatment group was directly correlated with a linear expansion in the animals' somatic body dimensions, with the P1 group recording an average chest circumference of 109.05 ± 0.32 cm and an average body length of 112.21 ± 0.30 cm. In contrast, the control group (P0) had an average chest circumference of only 91.90 ± 0.40 cm and body length of 99.15 ± 0.47 cm. The success in achieving these physical parameters demonstrates that the seaweed-based concentrate formulation can optimally stimulate the anabolic metabolism of Landrace pigs. This extremely rapid growth rate in pigs is influenced by the superior genetic traits of the Landrace breed itself, as well as the suitability of the feed formulation provided. Landrace pigs are known for their rapid growth and excellent feed conversion efficiency (Wheindrata, 2013; Dewi, 2017; Oroh et al., 2023).

These internal genetic factors can be expressed to their fullest potential when supported by a balanced nutrient supply and ideal housing conditions (Nababan et al., 2016). Furthermore, feed components are a key determinant of a farm's operational success, as they account for approximately 60–80% of the total production costs (Sihombing, 1997; Bana et al., 2018). From a veterinary physiological perspective, the significant growth acceleration in the P1 group was driven by the abundance of functional bioactive compounds and micronutrients in *Gracilaria* sp. These bioactive components, including saponins, steroids, and hydroquinone phenols, play a crucial role as natural antioxidants, effectively neutralizing free radicals and maintaining the stability of livestock metabolism (Ghazali et al., 2025). The mineral content of the feed supplied by this red alga, as reflected by its high ash content of 21.02% on a dry basis, helps meet the essential mineral requirements of pigs. In addition to being rich in minerals and vitamins, the fiber and active polyphenol content of seaweed exerts a physiological regulatory effect on digestion and helps maintain a balanced body weight in pigs (Hall et al., 2012; Purwaningsih & Deskawati, 2021).

In addition, feed concentrates rich in nutrients, protein, and metabolic energy have been shown to directly increase average daily gain (ADG) and improve feed conversion efficiency in livestock (Corino et al., 2019). This seaweed bran formulation acts as a natural prebiotic in the digestive tract of monogastric animals. Functional polysaccharide compounds from *Gracilaria* sp. promote gut health, strengthen pigs' resistance to digestive disorders, and optimize the absorption surface area of the small intestinal villi (Zou et al., 2021; Morais et al., 2020). This radical and efficient nutrient absorption process results in a significantly higher conversion of feed into muscle mass compared to that in the control group (P0), which received only traditional feed consisting of household food scraps or local plants. From a methodological perspective, the consistency of these monitoring results also confirms that the methods for estimating physical body dimensions (chest circumference and body length) exhibit highly reliable linear accuracy for periodically monitoring the body weight performance of Landrace pigs in the grower phase. Thus, the results of this study support the theory that the use of seaweed as an alternative feed ingredient has the potential to increase pig productivity through improved gastrointestinal health, enhanced nutrient utilization efficiency, and optimization of growth.

CONCLUSIONS AND SUGGESTIONS

Conclusions

The administration of a concentrate based on *Gracilaria* sp. seaweed bran significantly affected the growth of Landrace pigs. This was demonstrated by the increases in chest

circumference, body length, and body weight in the treatment group compared to those in the control group. The use of seaweed bran has the potential to serve as an effective and economical alternative feed ingredient to support pig productivity.

Suggestions

Further research is needed to determine the optimal dosage and long-term effects of *Gracilaria* sp. seaweed bran supplementation on the production performance and health of Landrace pigs.

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Tables

Table 1. Ingredient composition and nutrient content of the treatment concentrate (Dose: 1 kg/head/day).

Ingredient Components	Percentage (%)	Actual Weight (kg)
Seaweed meal (<i>Gracilaria</i> sp.)	69.7%	0.697
Copra meal	11.9%	0.119
Fish meal	18.4%	0.184
Total Composition	100%	1.000
Nutrient Content (Proximate Analysis)		
Crude Protein (CP)	—	16.01%
Crude Fiber (CF)	—	9.99%
Metabolizable Energy (ME)	—	2,945 kcal/kg

Table 2. Mean body morphometrics of Landrace pigs from baseline to Month 3.

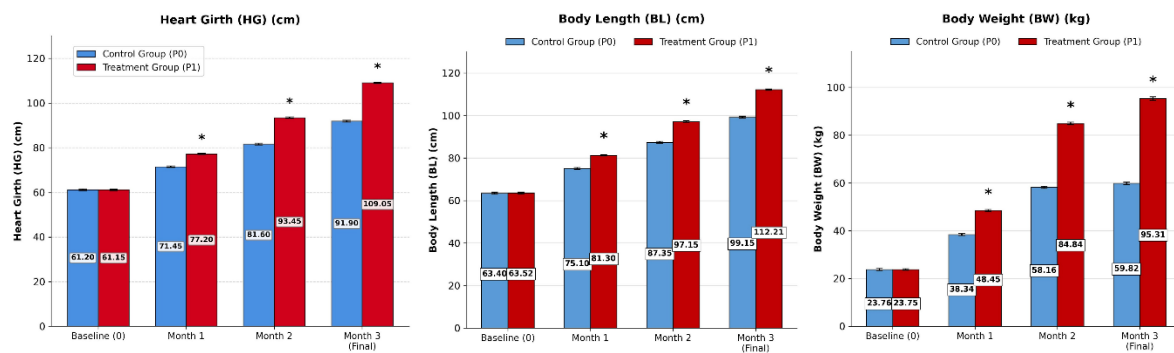
Parameter / Variable	Measurement Period	Control Group (Without Concentrate)	Treatment Group (Concentrate 1 kg/head/day)	P-value
Heart Girth (HG) (cm)	Baseline (Month 0)	61.20 ± 0.35	61.15 ± 0.32	$P > 0.05$
	Month 1	71.45 ± 0.38	77.20 ± 0.29	$P < 0.05$
	Month 2	81.60 ± 0.42	93.45 ± 0.31	$P < 0.05$
	Month 3 (Final)	91.90 ± 0.40	109.05 ± 0.32	$P < 0.05$
Body Length (BL) (cm)	Baseline (Month 0)	63.40 ± 0.45	63.52 ± 0.41	$P > 0.05$
	Month 1	75.10 ± 0.48	81.30 ± 0.35	$P < 0.05$
	Month 2	87.35 ± 0.51	97.15 ± 0.33	$P < 0.05$
	Month 3 (Final)	99.15 ± 0.47	112.21 ± 0.30	$P < 0.05$
Body Weight (BW) (kg)	Baseline (Month 0)	23.76 ± 0.38	23.75 ± 0.35	$P > 0.05$
	Month 1	38.34 ± 0.41	48.45 ± 0.43	$P < 0.05$
	Month 2	58.16 ± 0.44	84.84 ± 0.52	$P < 0.05$
	Month 3 (Final)	59.82 ± 0.46	95.31 ± 0.70	$P < 0.05$

Table 3. Mean ($\pm$ SD) body length, heart girth, and estimated body weight of Landrace pigs at the end of the trial period.

Parameter	Control Group (P0)	Treatment Group (P1)	P-value
Heart Girth (cm)	91.90 $\pm$ 0.40	109.05 $\pm$ 0.32	$P < 0.05$
Body Length (cm)	99.15 $\pm$ 0.47	112.21 $\pm$ 0.30	$P < 0.05$
Body Weight (kg)	59.82 $\pm$ 0.46	95.31 $\pm$ 0.70	$P < 0.05$

Note: Significant differences ($P < 0.05$) were observed between the control and treatment groups across all growth parameters.

Graph



Graph 1. Comparison of mean heart girth, body length, and body weight of Landrace pigs between the control (P0) and treatment (P1) groups. Blue bars represent the control group (P0); red bars represent the treatment group (P1); asterisks (*) indicate statistically significant differences ($P < 0.05$).

Figure



Figure 1. Documentation of the research procedures and outcomes: (1) measurement of body length, (2) measurement of heart girth, (3) research results, and (4) concentrate feed ingredients formulated with *Gracilaria* sp. seaweed meal.