



Effects of *Sargassum* (*Sargassum* sp.) on the growth performance of broiler

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Abstract

Poultry is a vital branch area of the agricultural economy and has traditionally been one of the most profitable businesses, providing nutritious meats and eggs for human consumption within the shortest possible time. Hence, this study was conducted to determine the different levels of Sun-Dried *Sargassum* (*Sargassum* sp.) meal as a feed supplement for broilers to determine the best treatment of dried sargassum meal (10%, 20%, 30%, and 40%) that could substitute commercial feeds from February 08, 2022, to April 04, 2022, at Barangay Carisquis, Luna, La Union. Results of the study disclosed that the average daily feed consumption and dressing percentage of birds were not significantly influenced by the different levels of sub-dried sargassum meal as a feed supplement. However, a significant result was noted on the final weight, gain weight of birds, feed conversion ratio, liver weight, gizzard weight and profit above, medicine, and stock cost of birds.

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Introduction

Poultry is a vital branch area of the agricultural economy and has traditionally been one of the most profitable businesses, providing nutritious meats and eggs for human consumption within the shortest possible time. However, the industry is now threatened by higher prices and the non-availability of feed ingredients, reflecting feed costs comprising 60-65% of the total cost of poultry production (Lambio, 2010).

In broiler production, feed cost constitutes the most significant operating cost. With this, many researchers focused on reducing feed costs to realize a larger profit. Using locally available materials as feed added to commercial feeds for broiler ration may be one solution to lower feed costs. Seaweeds have been used for many years for human consumption and animal feed. It is also an ingredient for the global food and cosmetics industries and is used as fertilizer and animal feed supplements. Also, seaweeds are valuable sources of micro food nutrients (Erum *et al.*, 2017).

Alternative feed ingredients offer the possible option to combat the inevitable price increases of conventional feedstuffs, particularly protein sources. Protein is one of the most essential and expensive nutrients to supplement the diet of all farm animals. One way is through introducing green plants, which are recognized as the cheapest and most abundant potential source of protein.

Seaweed has many essential nutrients especially trace elements and several other bioactive substances. That explains why today, seaweeds are considered a food supplement for the 21st century as a source of proteins, lipids, polysaccharides, minerals, vitamins, and enzymes (Rimber, as cited by Erum *et al.*, 2017). Seaweeds have been used in poultry to improve animal immune status, decrease the microbial load in the digestive tract, and benefit the quality of poultry meat and eggs (Erum *et al.*, 2017).

The nutritive value of Sargassum meal in the present study was predicted to be favorable based on its

proximate composition and apparent digestibility coefficient; it could serve as an energy source and possibly a mineral replacement. It is relatively digestible, and its crude protein and lipid digestibility were very high (Tumbokon *et al.*, 2015).

This study aims to evaluate the response of broilers as affected by the different levels of Sargassum (*Sargassum* sp.). Specifically, the study aimed to evaluate the growth performance of broilers as affected by varying levels of Sargassum (*Sargassum* sp.) as a feed supplement and evaluate the best level of sargassum meal on the growth performance of the broiler. It also determines the profit above feeds, medicine, and stock cost of broilers as affected by varying levels of Sargassum (*Sargassum* sp.) as a feed supplement.

Materials and methods

Research design

Seventy-five (75) head broiler chicks were randomly distributed into five treatments replicated three times with five birds per replicate following the Complete Randomized Design (CRD).

Experimental treatment

Commercial feeds were mixed with dry Sargassum meal containing T₀=Control (100% commercial feeds), T₁=90% commercial feeds + 10% dried Sargassum meal, T₂=80% commercial feeds + 20% dried sargassum meal, T₃=70% commercial feeds + 30% dried sargassum meal, and T₄=60% commercial feeds + 40% sargassum meal.

Materials and procedure

The materials that were used in the study were the following: Sargassum leaf, 75 broiler chicks, commercial feeds, brooding and rearing pens, feeding troughs, drinking containers, light bulbs, empty sacks, weighing scale, recording notebook, ball pen, and digital camera.

Preparation of pens

Before stocking birds, the experimental site and pens were cleansed and sanitized with soap and

disinfectant to remove or kill all unwanted and foreign organisms that may cause contamination or infection to the feeds, drinking water, and birds. The feeding troughs, drinking containers, and other equipment used in this study were also sanitized. Furthermore, electricity was installed for the lighting system.

Brooding management

The chicks were brooded for 14 days. Nine 10-watt incandescent bulbs supplied heat and light throughout the study. The walls were covered with empty sacks, and layers of old newspapers were used to cover the floor. The behavior of the birds was used to determine the temperature inside the pen. After brooding, the sacks and newspapers were removed to reduce the temperature and provide proper ventilation to the chicks. The same pens were used until the end of the study. The birds had the recommended space allowance of 1.0 sq. ft. per bird.

Feeding and watering system

Feeding of chicks started from the day of arrival. Before starting the experimental trial, the chicks were fed first with commercial feeds for 2 weeks to determine the acceptability and the amount of feed consumed per day by the chicks. After feeding commercial feeds, the experimental ration was given for 35 days after brooding to the hardening stage.

Three types of commercial feeds were given to the chicks. From the first day to 2 weeks old, the chicks were fed with chick booster second week to the fourth week with chick starter crumble. Four experimental rations were fed to the chicks throughout the study: Treatment 1, 90% of commercial feeds were mixed in 10% of dried Sargassum leaves. In treatment 2, 80% of commercial feeds were mixed in 20% dried Sargassum leaves. In treatment 3, 70% of commercial feeds were mixed with 30% dried Sargassum leaves. In treatment 4, 60% of commercial feeds were mixed with 40% dried Sargassum leaves. The ratio was given ad libitum to the chickens from the start until the end of the study.

The drinking container was provided on each pen. Fresh and clean water was given daily. Electrolytes and multivitamins soluble in water were mixed in their drinking water if needed.

Sanitation program

Cleaning of drinking containers was done daily. Manure removal was also done twice or thrice (if necessary) a week to prevent the fungi and bacterial growth surrounding the pens and the accumulation of ammonia.

Collection and processing of Sargassum meal

Sargassum leaves were gathered at Barangay Carisquis, Luna, La Union. The leaves were dried and mixed in commercial feeds containing the following treatments. In treatment 1, 90% of commercial feeds were mixed in 10% dried Sargassum leaves. In treatment 2, 80% of commercial feeds were mixed in 20% dried Sargassum leaves. In treatment 3, 70% of commercial feeds were mixed with 30% dried Sargassum leaves. Finally, in treatment 4, 60% of commercial feeds were mixed with 40% dried Sargassum leaves. All Sargassum leaves were chopped. The fresh Sargassum seaweeds were gathered from Carisquis, Luna, and La Union. The gathered seaweeds were sun-dried for three (3) days. The crispy leaves were shredded in the shredding machine. The ground sargassum was stored and kept airtight. The Sargassum was then weighed per the required amount per treatment and mixed with broiler commercial feeds.

Analysis of data

All the data gathered were tabulated and analyzed statistically using the Analysis of Variance (ANOVA) of Complete Randomized Design (CRD). The significant differences were tested using the Least Significance Difference (LSD).

Results and discussion

Initial weight

The mean initial weight of broilers randomly assigned to the different experimental diets is presented in Table 1.

Table 1. Mean initial weight of broiler chicken (kg).

Treatment	Mean ^{ns}
To- (Control) 100% commercial feeds	0.27
T1-90% commercial feeds + 10 % Dried Sargassum Meal	0.27
T2-80% commercial feeds + 20 % Dried Sargassum Meal	0.26
T3-70% commercial feeds + 30 % Dried Sargassum Meal	0.27
T4-60% commercial feeds + 40 % Dried Sargassum Meal	0.2733

*ns-not significant

The initial weight of broilers ranged from 0.26 kg to 0.27 kg. The Analysis of Variance revealed that there is no difference among treatment means. This implies that the mean of the experimental broilers was comparable at the start of the study. It means that the broilers were in great shape at the beginning of the study, and it can provide accurate experimental results for the study.

Table 2. Mean final weight of birds fed with sun-dried Sargassum meal (kg)

Treatment	Mean **
To- (Control) 100% commercial feeds	1.41 ^b
T1-90% commercial feeds + 10 % Dried Sargassum Meal	1.43 ^b
T2-80% commercial feeds + 20 % Dried Sargassum Meal	1.48 ^b
T3-70% commercial feeds + 30 % Dried Sargassum Meal	1.52 ^{ab}
T4-60% commercial feeds + 40 % Dried Sargassum Meal	1.65 ^a

*Means with the same letter are not significantly different

Final weight

The final weight of broilers fed with sargassum (*Sargassum spp.*) as feed extender is presented in Table 2. The birds fed with 60% commercial feeds + 40 % Dried Sargassum Meal got the heaviest weight of 1.65 kg while those birds fed with commercial feeds got the lightest weight of 1.41 kg.

Table 3. Mean gain in weight of broiler fed with sun-dried Sargassum meal (kg).

Treatment	Mean **
To- (Control) 100% commercial feeds	1.13 ^b
T1-90% commercial feeds + 10 % Dried Sargassum Meal	1.16 ^b
T2-80% commercial feeds + 20 % Dried Sargassum Meal	1.22 ^b
T3-70% commercial feeds + 30 % Dried Sargassum Meal	1.25 ^{ab}
T4-60% commercial feeds + 40 % Dried Sargassum Meal	1.37 ^a

*Means with the same letter are not significantly different.

The Analysis of Variance revealed highly significant differences among the treatments. Comparison among treatments means showed that the birds supplemented with 60% commercial feeds + 40% Dried Sargassum meal was comparable to those supplemented with 70% commercial feeds + 30 % Dried Sargassum Meal. But significantly higher than those birds supplemented with 80% commercial feeds + 20 % Dried Sargassum Meal, 90% commercial feeds + 10 % Dried Sargassum Meal, and 100% commercial feeds. This implies that feeding the birds using 60% commercial feeds + 40% dried sargassum and 70% commercial feeds + 30 % Dried Sargassum Meal increases the final weight. This is like the results of Kumar (2018), who claimed that Sargassum increased the weight gain of poultry partly due to its minerals, essential amino acids, and long-chain fatty acids necessary for growth and partly due to the enhancement of food intake and food conversion rate of chicks.

Table 4. Mean feed consumption of broilers fed with sun-dried Sargassum meal (kg).

Treatment	Mean ^{ns}
To- (Control) 100% commercial feeds	2.26
T1-90% commercial feeds + 10 % Dried Sargassum Meal	2.25
T2-80% commercial feeds + 20 % Dried Sargassum Meal	2.26
T3-70% commercial feeds + 30 % Dried Sargassum Meal	2.24
T4-60% commercial feeds + 40 % Dried Sargassum Meal	2.17

*ns-not significant

Gain in weight

The mean gain in weight of broilers fed with levels of Sargassum as feed extender is presented in Table 3. The result showed that broilers fed with 60%- 40% dried sargassum meal got the heaviest weight of 1.37 kg, while those birds fed with 100% commercial feeds gained the lightest weight of 1.13 kg.

The Analysis revealed highly significant differences among the treatments. Comparison among treatments means showed that the birds supplemented with 60% commercial feeds + 40% Dried Sargassum meal was comparable to those supplemented with 70% commercial feeds + 30 % Dried Sargassum Meal. But significantly higher than those birds supplemented with 80% commercial feeds

+ 20 % Dried Sargassum Meal, 90% commercial feeds + 10 % Dried Sargassum Meal, and 100% commercial feeds.

This implies that feeding the broilers using 60% commercial feeds + 40% dried Sargassum increases the gain weight of broiler chicken. The results are like the findings of Cocal (2022) that the gain in weight of the bird raises as a percentage of Sargassum was increased in the feed ration of the birds. Furthermore, Kumar (2018) claimed that Sargassum increased the weight gain of poultry partly due to its minerals, essential amino acids, and long-chain fatty acids necessary for growth and partly due to the enhancement of food intake and food conversion rate of chicks.

Table 5. Mean feed conversion ratio of broilers fed with sun-dried Sargassum meal

Treatment	Mean **
T0- (Control) 100% commercial feeds	2.00 ^a
T1-90% commercial feeds + 10 % Dried Sargassum Meal	1.93 ^a
T2-80% commercial feeds + 20 % Dried Sargassum Meal	1.86 ^a
T3-70% commercial feeds + 30 % Dried Sargassum Meal	1.80 ^{ab}
T4-60% commercial feeds + 40 % Dried Sargassum Meal	1.58 ^b

*Means with the same letter are not significantly different

Average daily feed consumption

The average daily feed consumption of broilers fed with levels of Sargassum as feed extender is presented in Table 4. Broilers fed with 40% dried sargassum meal 100% commercial feeds, as a feed extender for the broiler, to commercial broiler starter ration recorded feed consumption with a range of 2.17 kg to 2.6 kg.

The Analysis of Variance revealed no significant result indicating that the varying levels of dried Sargassum as a feed extender for broilers ration from 10% to 40% as feed extender to commercial feeds did not show any variations in the feed consumption among the experimental broilers. According to Andrei (2019), seaweed is an excellent supplement at 20 to 30 percent; seaweed meal mixed with commercial mash increased feed consumption and improved the skin

color of the broiler. Fan *et al.* (2021) concluded that Sargassum meal supplementation did not affect the daily feed intake of layers.

Feed conversion ratio

The mean feed conversion ratio of the broilers fed with varying levels of sargassum meal is presented in Table 5. Results showed that the birds fed with 60% sargassum meal + 40% commercial feed obtained the best conversion ratio of 1.58, while birds fed with pure commercial feeds got the poorest.

Analysis of variance revealed a highly significant result. Comparison among treatments means that the birds supplemented with 60% commercial feeds + 40% dried sargassum meal are comparable to those fed with 70% commercial feed + 30% dried sargassum meal. But significantly higher than those birds supplemented with 80% commercial feeds + 20% dried sargassum meal, 90% commercial feeds + 10% dried sargassum meal, and 100% commercial feeds.

This implies that feeding the broilers with 60% commercial feeds + 40 % dried sargassum meal will produce feed conversion efficiency, which the birds required only 1.58 kg to produce 1kg of meat. Although the highest feed conversion ratio was 2.0, noted in 100% commercial feeds, this is still classified into the technical production parameters in the Philippines, which has an average feed conversion ratio (FCR) of 2.0. Live birds usually are sold at 1.8 kilograms per bird in the Philippines. Trade contacts have reported a growing demand for larger birds (1.5 to 2.0 kg), specifically by the wet markets, which sell more chicken cuts than whole birds (USDA, 2005). It confirms that Sargassum is enough in the daily diet to produce the maximum weight gain in poultry since it can promote the maximum food conversion ratio. As a natural feed additive, Sargassum improved the diet palatability to intake more food than the control. It enhanced digestion, followed by intestinal absorption, as Michael and Kumawat (2003) and Alloui *et al.* (2012) noted. Furthermore, dietary supplementation of Sargassum increased poultry's feed conversion rate and weight gain (Mervat, 1993).

Liver weight

The mean liver weight of the broiler with varying levels of dried Sargassum as feed extender is shown in Table 6. The result showed that broilers fed with 60% commercial feeds + 40% dried sargassum meal got the heaviest weight of 31.00 g, while those birds fed with 90% commercial feeds + 10% dried sargassum meal got the lightest weight of 24.67 g.

Table 6. Mean liver weight of broiler fed with dried Sargassum meal (g).

Treatment	Mean *
To- (Control) 100% commercial feeds	25.00 ^b
T1-90% commercial feeds + 10 % Dried Sargassum Meal	24.67 ^b
T2-80% commercial feeds + 20 % Dried Sargassum Meal	25.33 ^b
T3-70% commercial feeds + 30 % Dried Sargassum Meal	27.67 ^{ab}
T4-60% commercial feeds + 40 % Dried Sargassum Meal	31.00 ^a

*Means with the same letter are not significantly different

Analysis of variance revealed significant differences among the treatments. Comparison among treatments means showed that the birds supplemented with 60% commercial feeds + 40% dried sargassum meal were comparable with birds supplemented with 70% commercial feeds + 30% dried sargassum meal. But significantly higher than those birds supplemented with 80% commercial feeds + 20% dried sargassum meal, 90% commercial feeds + 10% dried Sargassum, and 100% commercial feeds. This implies that the higher levels of dried Sargassum as a feed extender for the broiler may increase the weight of the liver of the broiler. Kumar (2018) confirms that the Sargassum treatment increased the liver weight from 2.26% to 2.30%; the maximum supplementary effect was noted at 1% and 2% of the Sargassum powder.

Gizzard weight

The mean gizzard weight of the broilers with varying levels of dried Sargassum as feed extender is shown in Table 7. The result showed that broilers fed with 60% commercial feeds + 40% dried sargassum meal got the heaviest weight of 38.33 g, while those birds fed with 100% commercial feeds got the lightest weight of 26.67 g.

Table 7. Mean gizzard weight of broiler fed with sun-dried Sargassum meal (g)

Treatment	Mean **
To- (Control) 100% commercial feeds	26.67 ^c
T1-90% commercial feeds + 10 % Dried Sargassum Meal	32.33 ^{abc}
T2-80% commercial feeds + 20 % Dried Sargassum Meal	31.00 ^{bc}
T3-70% commercial feeds + 30 % Dried Sargassum Meal	36.33 ^{ab}
T4-60% commercial feeds + 40 % Dried Sargassum Meal	38.33 ^a

*Means with the same letter are not significantly different.

The Analysis of variance revealed highly significant differences among the treatments. Comparison among treatments means showed that the birds supplemented with 60% commercial feeds + 40% dried sargassum meal were comparable with birds supplemented with 70% commercial feeds + 30% dried sargassum meal and similar with 80% commercial feeds + 20% dried sargassum meal, 90% commercial feeds + 10% dried sargassum meal but not comparable in To with 100% commercial feeds. This implies that the higher levels of dried Sargassum as a feed extender for the broiler may increase the weight of the gizzard of the broiler. Kumar (2018) confirms that the Sargassum treatment increased the gizzard from 1.76% to 1.83%; the maximum supplementary effect was noted at 1% and 2% of the Sargassum powder.

Table 8. Mean dressing percentage of broiler fed with sun-dried Sargassum meal (%)

Treatment	Mean ^{ns}
To- (Control) 100% commercial feeds	78.15
T1-90% commercial feeds + 10 % Dried Sargassum Meal	85.01
T2-80% commercial feeds + 20 % Dried Sargassum Meal	79.08
T3-70% commercial feeds + 30 % Dried Sargassum Meal	82.34
T4-60% commercial feeds + 40 % Dried Sargassum Meal	74.89

ns=not significant

Dressing percentage

The mean dressing percentage of broilers with varying levels of dried Sargassum as feed extender is presented in Table 8. The mean result showed that the dressing percentage ranged from 74.89 to 85.01, with dried Sargassum as the feed extender.

Birds fed with T1 had the highest dressing percentage of 85.01%, and those birds with T4 obtained the lowest dressing percentage of 74.89 %.

Analysis of Variance revealed no significant differences among the treatment means. The result implies that feeding the birds with *Sargassum* sp. at an increasing level reduces the fat pads of the birds. The carcass quality was improved due to reduced fats Erum and Frias (2017).

Profit above feed, medicine, and stock cost of the birds (Php)

The mean profit above feeds and the dried Sargassum and stock cost of broilers with varying levels of dried Sargassum as feed extender is presented in Table 9. The result showed that broilers fed with 60% commercial feeds + 40% dried sargassum meal got the highest profit at 139.57 pesos, while those birds fed with 100% commercial feeds got the lowest yield at 90.52 pesos.

Table 9. Profit above feed, medicine, and stock cost of the birds (Php).

Treatment	Mean **
T0- (Control) 100% commercial feeds	90.52 ^c
T1-90% commercial feeds + 10 % Dried Sargassum Meal	96.82 ^{bc}
T2-80% commercial feeds + 20 % Dried Sargassum Meal	105.99 ^{bc}
T3-70% commercial feeds + 30 % Dried Sargassum Meal	115.16 ^b
T4-60% commercial feeds + 40 % Dried Sargassum Meal	139.57 ^a

*Means with the same letter are not significantly different.

The Analysis of variance revealed highly significant differences among the treatments. Comparison among treatments means showed that the birds supplemented with 60% commercial feeds + 40% dried sargassum meal was highly significant differences among treatments, but the birds supplemented with 70% commercial feeds + 30% dried sargassum meal and comparable with 80% commercial feeds + 20% dried sargassum meal, and 90% commercial feeds + 10% dried sargassum meal but significantly different to birds fed with 100% commercial feeds. This implies that the as the

percentage of sargassum increase from 30% to 40%, the profit increase. The result conforms to the study of Erum *et al.* (2019); the dried brown seaweeds could help the local producers of broilers to reduce feed costs to realize a more significant profit.

Conclusion

As the percentage of dried sargassum meal in commercial feeds increases, it also increases broiler weight in terms of final weight, gain in weight, feed intake and feed conversion ratio, gizzard, and liver weight. The best level of sargassum meal on the growth performance of broiler among treatments is 30% - 40%. Broilers feed with 40 % dried Sargassum as a feed extender will gain higher profitability and be locally available to nearby areas. Based on the conclusions, the researcher recommends 10% to 40% of dried Sargassum as feed extender for broilers.

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