RESEARCH ARTICLE Indian Journal of Animal Research, Volume 56 Issue 12: 1519-1522 (December 2022)

Reducing Salt (NaCl) Content of Seaweed (*Turbinaria decurrens*) before Being Used as Poultry Feed Ingredients

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10.18805/IJAR.BF-1459

ABSTRACT

Background: Seaweed (*Turbinaria decurrens*) had been included 10% in broilers' diets. However, it affected production performance of broilers due to the high in its NaCl content (11.20%). Broilers can only tolerate up to 0.5%, while ideal amount in broilers' diets is 0.2% Na and 0.3% Cl. Thus, it is necessary to reduce NaCl content of this seaweed.

Methods: This study was performed in a completely randomized design with 6 treatments and 4 replicates. Treatments were immersing duration (0, 3, 6, 9, 12 and 15 hours) of *T. decurrens* in running water. Measured variables were NaCl, dry matter, organic matter, crude protein and crude fiber contents of *T. decurrens*. Data were analyzed by analysis of variance of completely randomized design and differences among treatment means were detected by Duncan multiple range test.

Result: Immersing duration significantly affected (P<0.05) all measured variables (NaCl, dry matter, organic matter, crude protein and crude fiber contents). Immersing duration up to 15 hours reduced NaCl, dry matter and crude fiber, but increased organic matter and crude protein contents. The best treatment for reducing NaCl of *T. decurrens* was by immersing it in running water for 15 hours.

Key words: Immersing duration, Nutrient, Salt (NaCl), *Turbinaria decurrens*.

INTRODUCTION

Corn, soybean meal and fish meal are the main ingredients in the diet of poultry. The availability of these corn, soybean meal and fish meal is not continuous and is a national problem in the livestock and poultry business in Indonesia. The use of corn as a feed for poultry still has problems because corn production is not sufficient for domestic needs. Its utilization is still competitive with human needs as food and bio-ethanol product and the price is relatively expensive. Diversification of feed ingredients and exploration of national natural resources should be done to reduce imported feed ingredients and support the national food security program.

The continuity of the availability of feed ingredients and not competing with food ingredients, is an absolute requirement for animal feed ingredients in reducing imported feed ingredients. Materials that meet these requirements usually come from agricultural waste materials or industrial by-products. Research on the use of agricultural waste materials for animal feed has been widely studied. Our previous research showed that juice waste mixtures from carrot and several fruit peels (apple, mango, avocado, orange, melon and tree tomato) in the same proportion could be used up to 20% in broiler diets (Rizal *et al*., 2010) and after treated with rice-hull ash filtrate could be used up to 40% in broiler rations (Mahata *et al*., 2013). Meanwhile, tomato waste boiled for 8 minutes could be used 7% in ration of broilers (Mahata *et al*., 2016) and 12% in laying rations (Mahata *et al*., 2020).

Indonesia's marine potential with its diversity of contents is an asset in finding new and continuously available sources of animal feed ingredients. Indonesian seaweed has not been touched and used as a source of feed ingredients, there have not been many research reports on its use as poultry feed, even though the Indonesian sea is very wide and has 12 to 14 types of seaweed from the total 60 types of seaweed in the world's seas. Seaweed contains nutrients needed by livestock and secondary metabolites alginate, fucoidan and fucoxanthin which are known as anti-oxidants and can lower cholesterol. The seaweed *Turbinaria decurrens* is classified as brown seaweed (Phaeophyceae) which is spread in Indonesian seas. This seaweed contains 3.40% protein, 0.91% fat, 16.86% crude fiber, 1528 ME (kcal/kg), 1.92% Ca, 0.97% P, 7.70% alginate and 11.20% NaCl (Mahata, *et al*., 2015). The use of seaweed *T. decurrens* up to 10% in broiler rations can still be tolerated by the physiological organ of broilers, but it interferes with their performance. The limitation of its use is due to the high salt content of 11.20% and the high crude fiber content of 16.86% (Mahata *et al*., 2015). According to Mavromichalis (2016), the ideal salt content in the diet for poultry was 0.5% which provided 0.20% Na and 0.30% Cl. Meanwhile, NRC (1994) and Mavromichalis (2016) figured out that the requirement of NaCl in poultry is low and is ranged from about 0.10-0.25% in a complete feed. Meanwhile, the inclusion of 10%

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How to cite this article: Rizal, Y., Reski, S., Mahata, M.E. and Yuniza, A. (2022). Reducing Salt (NaCl) Content of Seaweed (*Turbinaria decurrens*) before Being Used as Poultry Feed Ingredients. Indian Journal of Animal Research. 56(12): 1519-1522. DOI: 10.18805/IJAR.BF-1459.

Submitted: 28-10-2021 **Accepted:** 29-06-2022 **Online:** 16-08-2022

seaweed *T. decurrens* will bring up more than 1.0% NaCl in the diet.

Efforts to reduce NaCl content of feeds might be performed through immersion in running water. According to Reski *et al*. (2020), the immersion of seaweed *Turbinaria murayana* in running water for 3 hours can reduce the salt content of the seaweed from 14.4% to 0.76% NaCl. Previously, Dewi *et al*., (2018) also reported that soaking seaweed *Sargassum binderi* in running water for 15 hours was the best immersion treatment in reducing salt (NaCl) content before being used as feed ingredients in laying hen's rations. Based on the above thoughts, an experiment had been carried out to reduce the salt content (NaCl) of *T. decurrens* to less than 1.0% by immersion in running water.

MATERIALS AND METHODS

This research was conducted in the irrigation canal of Mount Nago, Padang City, West Sumatra, Indonesia for immersing of seaweed and at the Laboratory of Non-Ruminant Nutrition and the Laboratory of Livestock Biotechnology, Faculty of Animal Science, Universitas Andalas, Padang, Indonesia for analyzing its NaCl and nutrient contents from February - April 2021.

The material used in this study was *T. decurrens* brown seaweed which was taken from Sungai Nipah Beach, Pesisir Selatan Regency, West Sumatra, while the equipment were nets for soaking, sacks, plastic ropes, tarpaulins, aluminum foil, scales, blenders, cutting tools, jars and ovens.

T. decurrens seaweed from Sungai Nipah Coast, Pesisir Selatan Regency, West Sumatra was taken from 5 different locations, then combined to be used as research samples. These samples were taken and brought to a location or place for immersion in running water at Irrigation canal, Gunung Nago with a depth of 1.65 m and a water discharge of 0.0610 m3/s (Reski *et al*., 2020). The seaweed obtained, before being immersed in running water, was washed and cleaned first of the remnants of sea sand, small corals attached to the seaweed, then soaked in running water according to the immersion treatment, *i.e.* 0, 3, 6, 9, 12 and 15 hours. After immersing, *T. decurrens* seaweed was dried to a moisture content of 12-14% and finely ground to a powder form and then analyzed for its NaCl and other nutrient contents.

The measured variables were: NaCl (Titration Method using AgNO3 according to Kohman, in Sudarmadji *et al*., 1997), Dry Matter (AOAC, 1990), Organic Matter (AOAC, 1990), Crude Protein (AOAC, 1990) and Crude Fiber (AOAC, 1990).

This study used a completely randomized design (CRD) experimental method with 6 different immersing duration of *T. decurrens* (0, 3, 5, 9, 12 and 15 hours) in running water and 4 replicates. Data obtained were analyzed by analysis of variance of a CRD and if there were the differences among treatment means, then further testing was carried out with Duncan Multiple Range Test (Steel and Torrie, 1991).

RESULTS AND DISCUSSION

The effect of immersing duration on NaCl, dry matter, organic matter, crude protein and crude fiber contents of *T. decurrens* are depicted in Table 1.

Salt (NaCl) content

The average NaCl content of *T. decurrens* in each immersion treatment can be seen in Table 1. Immersion of *T. decurrens* brown seaweed in running water with different immersion duration showed a highly significant difference (P≤0.01) on the NaCl content of the *T. decurrens.* The decrease in salt content (NaCl) of *T. decurrens* seaweed in each immersion duration was caused by the bonding and attraction of water during immersion which can attract and dissolve the salt contained in seaweed, as water is an organic solvent that can dissolve ions such as salt (NaCl). Reski *et al*., (2020) reported that soaking seaweed in running water can reduce the salt content of the *Turbinaria murayana* seaweed, because water is an excellent solvent in dissolving ions such as salt and water can also bind and clean sand attached to the seaweed. According to Dewi *et al*., (2018), soaking *Sargassum binderi* in running water for 15 hours is the best immersion duration in reducing the NaCl content of the seaweed before being used in laying hens rations. The best immersion duration in this experiment was found in 15 hours with a NaCl content of 0.77% so that it can be safely used as a feed ingredient in poultry rations.

Dry matter content

The average dry matter content of *T. decurrens* seaweed in each immersion treatment can be seen in Table 1.

Table 1: Average nutrient contents (NaCl, dry matter, organic matter, crude protein and crude fiber) of *Turbinaria decurrens* soaked in running water for different immersing duration (%).

Treatments	NaCl	Dry matter	Organic matter	Crude protein	Crude fiber
(A) Immersing duration 0 h	14.31^{a}	93.32^{a}	54.91^{c}	4.23^{b}	13.42^{a}
(B) Immersing duration 3 h	8.69^{b}	90.06^{c}	73.33^{b}	4.84^{a}	10.16^{b}
(C) Immersing duration 6 h	6.64^{c}	91.84^{b}	72.32^{b}	4.73^{a}	9.49^{b}
(D) Immersing duration 9 h	4.96^{d}	90.76^{c}	74.64^{ab}	4.83^{a}	9.45^{b}
(E) Immersing duration 12 h	2.58^{e}	91.95^{b}	76.09^{a}	4.93^{a}	9.60^{b}
(F) Immersing duration 15 h	0.77^{f}	91.67^{b}	75.93^{a}	4.67^{a}	10.64^{b}
SEM	0.12	0.29	0.83	0.14	0.69

^{a,b,c,d,e,f} Means with different superscripts in every column indicated significantly differed (P≤0.01).

SEM= Standard error of the mean.

The results showed that the immersion of *T. decurrens* seaweed in running water with different immersion duration had a highly significant effect (P≤0.01) on the dry matter content of this *T. decurrens*. The dry matter content of *T. decurrens* seaweed in treatment A (without immersion) was higher than that of the immersion treatments. This is because the immersion treatment with running water with different immersion duration causes the NaCl content to decrease so that the dry matter content of the material decreases. NaCl is part of the ash and the ash is part of the dry matter, so the increasing immersion duration will also reduce the dry matter content of *T. decurrens* seaweed. According to Dewi *et al*., (2018) the long treatment of immersion *Sargassum binderi* type of seaweed in running water can reduce the dry matter content compared to without immersing. Furthermore, Reski *et al*., (2020) also reported that the immersion of *Turbinaria murayana*, brown seaweed, in running water with different immersion duration for use as broiler feed material caused a decrease in the dry matter content. Immersion of *Turbinaria murayana* seaweed in running water with different durations of immersion is best for the immersion for 3 hours (Reski *et al*., 2020).

Organic matter content

The average organic matter content of *T. decurrens* seaweed in each immersion duration treatment is depicted in Table 1. The results showed that the soaking of *T. decurrens* seaweed in running water with different immersion duration significantly affected (P≤0.01) the organic matter content of *T. decurrens* seaweed. The organic matter content of Turbinaria decurrens seaweed in treatment A (without immersion) was lower than that of *T. decurrens* seaweed immersed in running water (treatments B, C, D, E and F). The increase in organic matter in the immersion treatment in running water is due to the dissolution of several substances that are easily soluble in water such as salt and water-soluble vitamins in the immersion treatment. The dissolution of nutrients such as salt and water-soluble vitamins in *T. decurrens* seaweed soaked in running water will increase the percentage of the organic matter content of the material. According to Dewi *et al*., (2018) soaking *Sargassum binderi* type seaweed with different soaking times in running water can increase the organic matter content of the material. Kwari *et al*., (2011) also reported that materials that are treated with a water immersion process will cause the loss of some dissolved substances in the water, thus increasing the organic matter of the material.

Crude protein content

The average crude protein content of *T. decurrens* seaweed in each immersion treatment is performed in Table 1. The results showed that the immersion of *T. decurrens* seaweed in running water with different immersion duration had a highly significant effect (P≤0.01) on its crude protein content. The crude protein content of *T. decurrens* soaked in running water in treatments B, C, D, E and F was higher than the crude protein content of *T. decurrens* without immersion (treatment A). The increase in crude protein content of *T. decurrens* in the immersion treatment was due to the presence of dissolved substances in the seaweed such as NaCl and water-soluble vitamins that dissolved during the immersion treatment in running water, so it would cause the percentage of organic matter to increase and will also cause the percentage of organic matter to increase. Crude protein increases, because crude protein is part of organic matter. According to Reski *et al*., (2020) that the immersion of *Turbinaria murayana* seaweed in running water with different immersion duration can increase the crude protein content of the material. Furthermore, Dewi *et al*., (2018) also reported that the immersion treatment in running water using *Sargassum binderi* type seaweed with different immersing duration can also increase the crude protein content of the material.

Crude fiber content

The average crude fiber content of *T. decurrens* seaweed in each immersion treatment is figured out in Table 1. The immersion of *T. decurrens* seaweed in running water with different immersion duration very significantly influenced (P≤0.01) its crude fiber content. The crude fiber content of *T. decurrens* seaweed in the immersion treatment in running water was lower than that of the crude fiber content in the treatment without immersion. The low crude fiber content in *T. decurrens* seaweed in each immersion treatment was due to the lower dry matter content in the immersion treatment than in the non-soaking treatment, so it would also cause crude fiber content in *T. decurrens* seaweed in the immersion treatment (B, C, D, E and F) were lower than treatment A (without immersion). According to Dewi *et al*., (2018), the soaking treatment of *Sargassum binderi* type seaweed in running water reduces the dry matter content of the material, thus also causing the crude fiber content of the material to decrease. Udensi *et al*., (2010) reported that the material processing using boiling, soaking and autoclaving methods causes the nutritional substances of the material to decrease so that the dry matter and crude fiber content of the material is also reduced. Furthermore, it is also supported by El-Deek *et al*., (2011) that seaweed processed by soaking in hot water or boiling can reduce the crude fiber content of the material.

CONCLUSION

Processing to reduce the salt content (NaCl) of brown seaweed *Turbinaria decurrens* by immersing in running water can reduce its NaCl content. The best immersion duration treatment was found in the 15-hour immersing treatment with NaCl content of 0.77%, dry matter 91.67%, organic matter 75.93%, crude protein 4.67% and crude fiber 10.64%.

ACKNOWLEDGEMENT

This research was funded by the Ministry of Higher Education, Research and Technology through the contract

No. 266/E4.1/AK.04.PT/2021. We are very grateful to the Minister of Higher Education, Research and Technology of the Republic of Indonesia who has supported us to perform this research. Special thanks also go to the Rector of the Universitas Andalas and the Dean of the Faculty of Animal Science who have given us the chance to conduct this experiment.

Conflict of interest: None.

REFERENCES

AOAC. (1990). Official Methods of Analysis 15 edition. Association of Official Analytical Chemistry.

Dewi, Y.L., Yuniza, A., Nuraini, Sayuti, K. and Mahata, M.E. (2018). Immersion of *Sargassum binderi* seaweed in river water flow to lower salt content before used as feed for laying hens. International Journal of Poultry Science. 17(1): 22-27. DOI: 10.3923/ijps.2018.22.27.

El-Deek, A.A., Al-Harthi, M.A., Abdalla, A.A. and Elbanoby, M.M. (2011). The use of brown marine algae in finisher broiler diets. Egypt Poultry Science. 31(IV): 767-781.

Kwari, I.D., Igwebuike, J.U., Mohammed, I.D. and Diarra, S.S. (2011). Growth, hematology and serum biochemistry of broiler chickens fed raw or differently processed sorrel (*Hibisccus sabdariffa*) seed meal in a semi-arid environment. International Journal of Science and Nature. 2(1): 22-27.

Mahata, M.E., Dewi, Y.L., Sativa, M.O., Reski, S., Hendro, Zulhaqqi and Zahara, A. (2015). Potensi Rumput Laut Coklat Dari Pantai Sungai Nipah Sebagai Pakan Ternak (The potency of Brown Seaweed in Sungai Nipah Beach as a Feed). Laporan Penelitian Mandiri (Research Report), Fakultas Peternakan (Faculty of Animal Science) Universitas Andalas. http://repo.unand.ac.id/44776/.

Mahata, M.E., Sasti, M.J., Aryani, R.S., Rizal, Y. and Wu, G. (2013). The effect of improved juice waste mixture (IJWM) for corn substitution on broilers' performance. International Journal of Poultry Science. 12(2): 102-106.

Mahata, M.E., Manik, J., Taufik, M., Rizal, Y. and Ardi. (2016). Effect of different combination of unboiled and boiled tomato waste in the diet on internal organ development and serum lipid profile of broiler chickens. International Journal of Poultry Science. 15(7): 283-286.

Mahata, M.E., Hidayat, T., Nurhuda, G.A., Rizal, Y. and Ardi. (2020). Performance and egg quality of laying hens fed with boiled tomato waste powder. Journal of World Poultry Research. 10(1): 12-16.

Mavromichalis, I. (2016). How Much Salt Should you Add in your Animal Feed Diets. Feed Strategy. https://www.wattagnet.com/articles/27565-how-much-salt-should-you-add-in-your-animal-feed-diets.

NRC. (1994). Nutrient Requirements of Poultry: Ninth Revised Ed. The National Academies Press, Washington, DC. p 27.

Reski, S., Mahata, M.E. and Rizal, Y. (2020). Perendaman Rumput Laut *Turbinaria murayana* dalam Aliran Air Sungai sebelum digunakan sebagai Bahan Pakan Unggas (Soaking seaweed (*Turbinaria murayana*) in running water before utilization in poultry diets). Jurnal Peternakan Indonesia. 22(2): 211-217. DOI: 10.25077/jpi.22.2.211-217.2020 (In Indonesian).

Rizal, Y., Mahata, M.E. andriani, M. and Wu, G. (2010). Utilization of juice wastes as corn replacement in the broiler diet. International Journal of Poultry Science. 9(9): 886-889.

Steel, R.G.D. and Torrie, J.H. (1991). Principles and Procedures of Statistics: An Approach to Biometrics. Second Ed. PT. Gramedia Pustaka Utama, Jakarta (In Indonesian).

Sudarmadji, S., Haryono, B. and Suhardi (1997). Analysis of Food and Agriculture Substance. Liberty Yogyakarta, Yogyakarta (In Indonesian). p 107.

Udensi, E.A., Arisa, N.U. and Ikpa, E. (2010). Effects of soaking and boiling and autoclaving on the nutritional quality of *Mucuna flagellipes* (ukpo). African Journal of Biochemistry Research. 4(2): 47-50.