

The Effect of Boiling Mangrove (*Avicennia marina*) Leaves OninVitro Nutrients Digestibility and Tannin Content as Animal Feed

by Ilham Wahyudi

Submission date: 12-Apr-2023 11:18PM (UTC-0400)

Submission ID: 2063125778

File name: Artikel_Ali_baru.pdf (210.66K)

Word count: 3580

Character count: 19550



Research Paper

1
The Effect of Boiling Mangrove (*Avicennia marina*) Leaves Onin-Vitro Nutrients Digestibility and Tannin Content as Animal Feed

Ali Akbar¹, Novirman Jamarun^{2*}, Elihasridas², Tri Astuti³, Gusri Yanti¹

¹Postgraduate Program, Andalas University, Padang, Indonesia

²Lecturer at the Faculty of Animal Husbandry, Andalas University, Padang, Indonesia

³Lecturer at the Faculty of Agriculture, Mahaputra Muhammad Yamin University, Solok

*Corresponding author: Novirman Jamarun

4
ABSTRACT: Mangrove (*Avicennia marina*) is a highly nutritional plant that can be used as an alternative feed for ruminants. However, it has adverse effects when consumed in numerous quantities, due to the presence of anti-nutritional substances. The purpose of this research is to analyze the effect of boiling mangrove leaves (*Avicennia marina*) in husk ash water (15% w / v) to determine the in-vitro nutrients digestibility as well as the tannin and phenol contents, thereby making it usable for animal feed. The in-vitronutrients digestibility values observed were In-Vitro Crude Fiber Digestibility (IV-CFD), In-Vitro Crude Fat Digestibility (IV-CFtD), and In-Vitro Nitrogen Free extract Digestibility (IV-NFED) as well as tannins and phenols contents. This is an experimental research with a randomized block design (RBD), comprising of 4 treatments and 5 replications. The four treatments are P0: without boiling, P1: boiling for 5 minutes, P2: boiling for 10 minutes, and P3: boiling for 15 minutes. The results of the experiment showed that the boiling time gave a significant effect ($P < 0.01$) on in-vitronutrients digestibility of crude fiber, crude fat, and NFE, as well as tannin and phenol contents of mangrove leaves. Therefore, based on this research, it can be concluded that the optimum boiling time for mangrove leaves was 10 minutes as shown from the high In-Vitro nutrient digestibility that is IV-CFD 77.48%, IV-CFtD 31.80%, IV-NFED 64.57%, and tannin content 10.27%, and phenol 99.29 mgGAE.

KEYWORDS: *Avicennia marina*, husk ash, boiling, nutrients digestibility, tannins

6
Received 16 October, 2020; Accepted 31 October, 2020 © The author(s) 2020.

Published with open access at www.questjournals.org

4 I. INTRODUCTION 4

The feed is one of the main factors used to determine a successful livestock business because 60 - 80% of the total production costs for ruminants are associated with this food product [1]. The natural feed for ruminants such as field grass, agricultural waste, and some superior grass are collectively called forages.

However, the increasing limited availability of forages is one of the obstacles recently faced by breeders. [2] stated that the limited availability of forages occurs due to changes in land functions from food and industrial crops to residential areas. Therefore, due to this situation, it is important to determine alternative feed sources by utilizing local raw materials that are available in large quantities, and easy to obtain with high nutrient content.

One of the plants that can be used as an alternative feed for ruminants is mangrove leaves (*Avicennia marina*), a tropical plant from the genus *Avicennia*. According to [3], Indonesia is a country with the largest mangrove forest in the world, which is approximately 22.6% or 3.1 million ha. The most important contribution of mangrove forests to coastal water ecosystems is through the decay of their fallen leaves into the water, which is about 7-8 tonnes/ha/year [4].

Mangrove forests are protected areas that require selective efforts in their utilization. According to forestry law no.41 of 1991 article 8 paragraph (2), forest areas are designated with special purposes as intended for public interests such as research and development, education and research, religion, and culture.

Avicennia marina contains protein, fat, crude fiber, BETN, and ash in percentage values of 14.75%, 4.80%, 13.29%, 42.74%, and 16.02%. However, mangrove leaves also contain anti-nutritional compounds in the form of tannins (18%), therefore, it tends to have a negative effect on livestock when consumed in large quantities [5]. According to [6], the tannin content in mangrove leaves is 13.44%.

1 The Effect of Boiling Mangrove (*Avicennia marina*) Leaves Onin-Vitro Nutrients Digestibility ..

Therefore, one of the efforts used to reduce tannin levels in mangrove leaves is by boiling it using husk ash water. This process is defined as the act of mixing water with husk ash through heating and at a temperature of 100°C. Therefore, the husk ash water has the potential to be an absorbent material for cell fluids, inhibits the oxidation rate of toxic substances, and weakens the alkaline solutions capable of deactivating tannin properties.

Based on the description above, this study was carried out to determine the best time for boiling mangrove leaves (*Avicennia marina*) using husk ash water. Furthermore, this research was carried out to increase digestibility and reduce the tannins content, therefore it can be used as a ruminant feed to determine the in-vitro process on the digestibility of crude fiber, crude fat, BETN, tannins, and phenols.

7 II. MATERIALS AND METHODS

Research Materials: The materials used were goat rumen fluid, mangrove leaves (*Avicennia marina*) obtained from Nagari Terusan, Pesisir Selatan Regency, husk ash, aquades, Mc. Dauglls solutions as buffers and chemicals for *in-vitro* analysis. This research was carried out from October 2019 to January 2020.

Research Tools: The research tools used consists of laboratory equipment such as scales, centrifuge, thermometer, measuring glasses, test tube, Erlenmeyer, *in-vitro* tube, water shaker bath, oven, etc.

Method: The method used in this study is an experimental method, using a Randomized Block Design (RBD) with 4 treatments and 5 groups, where each treatment uses 15% (w/v) of husk ash water. The treatment consist of P0: without boiling, P1: 5 minutes of boiling, P2: 10 minutes of boiling and P3: 15 minutes of boiling. Boiling is carried out in a solution of husk ash water with a concentration of 15% (w / v), (Nirwani. S and Endang, 2017).

Observed Variables: The variables measured were In-Vitro Crude Fiber Digestibility (IV-CFD), In-Vitro Crude Fat Digestibility (IV-CFD), and In-Vitro Nitrogen Free Extract digestibility (IV-NFED) using the Tilley and Terry method [7]. Tannin content and total phenol calculations were conducted using the AOAC (1999[8], [9], and [10] methods.

III. RESULTS AND DISCUSSION

The chemical composition of research materials based on treatments of mangrove leaves (*Avicennia marina*) is presented in Table 1. In general, the nutritional content of the ingredients fluctuates in each treatment. Dry material is the material left behind after evaporation of the air as a whole contained in the feed ingredients. The average amount of dry matter contained in *Avicennia marina* leaves can be seen in Table 1. The nutritional value of mangrove leaves (*Avicennia marina*) shows that boiling treatment with husk ash water on mangrove leaves has a very significant effect (P <0.01) on dry matter. where there is a significant decrease between P0 (94.89%), P1 (91.34%), P2 (89.05%), and P3 (88.83%).

2 Table 1. Chemical composition of mangrove leaves for each treatment.

Nutritional Data (%)	Mangrove Leaves (<i>Avicennia marina</i>)			
	P0	P1	P2	P3
Dry Matter (%) ^a	91,34	94,89	95,04	95,60
Organic Matter (%) ^a	88,58	89,21	89,41	89,35
Crude Protein (%) ^a	11,40	14,20	13,50	13,04
Crude Fat (%) ^a	2,77	2,75	2,57	3,58
Crude Fiber (%) ^a	8,42	7,28	6,42	9,23
BETN (%) ^a	65,99	64,98	66,92	63,50
Ash (%) ^a	2,76	5,68	5,63	6,25
NDF (%) ^b	30,28	30,22	27,10	32,29
ADF (%) ^b	19,90	19,63	18,14	20,95
Cellulose (%) ^b	8,72	8,37	8,49	8,50
Hemicellulose (%) ^b	10,37	10,16	9,00	10,67
Lignin (%) ^b	10,99	11,00	9,33	12,18
Silica (%) ^b	0,19	0,26	0,28	0,27
Tannin (%) ^c	11,10	14,91	10,27	10,89

Note: P0 (0 minutes), P1 (5 minutes), P2 (10 minutes), P3 (15 minutes).

a) Analysis from Feed Industry Technology Laboratory 2020, ^b) Analysis from Animal Logistics Indonesia Netherlands (ALIN) Laboratory, Bogor 2020 and ^c) Analysis from Agricultural Technology Laboratory 2020.

1
The Effect of Boiling Mangrove (*Avicennia marina*) Leaves Onin-Vitro Nutrients Digestibility ..

The protein content of *Avicennia marina* leaves decreased during the boiling process in P2 treatment (10 minutes), while boiling for 5 minutes and 15 minutes increased protein levels. It is assumed that after 10 minutes of boiling, there was a reduction in the mass of *Avicennia marina* leaves and no further decrease in protein and starch levels, so the percentage of these substances increased. Research by [9] states that boiling for a longer time can increase the absorption of water, crude protein and carbohydrate content. The protein content will be increasingly denatured so that it breaks down into more easily digested amino acids. According to [10] that heating treatment can increase the level of protein digestibility by opening protein structures due to denaturation. However, [11] stated that heating treatment can cause a decrease in protein quality due to the denaturation process and the Maillard reaction at high temperatures. The results of the research by [12] stated that boiling the jatropha seeds for more than 10 minutes can reduce the protein and ricin content of the seeds.

In-Vitro Crude Fiber digestibility (IV-KFD), In-Vitro Crude Fat digestibility (IV-KFd) and In-Vitro NFE digestibility (IV-NFED)

5
 The different treatment effects on the *In-vitro* digestibility of crude fiber, crude fat, and NFE on the boiling process of mangrove leaves (*Avicennia marina*) using husk ash water are shown in Table 2. The variance analysis showed that the use of husk ash water on mangroves leaves had a significant effect ($P < 0.01$) on the *In-Vitro* digestibility of crude fiber, crude fat, and NFE.

Table 2. Average *In-vitro* digestibility of crude fiber, crude fat, and BETN

Treatment	IV-CFd	IV-CFD	IV-NFED
P0	18,80 ^a	76,95 ^b	56,82 ^d
P1	25,03 ^b	72,31 ^c	60,00 ^e
P2	31,80 ^a	77,48 ^a	64,57 ^a
P3	14,30 ^d	64,26 ^d	60,79 ^b
SE	0,29	0,32	0,39

Note: Different superscripts in the same column are significantly different ($P < 0.05$).

IV = In-vitro, CFD = Crude fiber digestibility, CFd = Crude fat digestibility, NFED = Nitrogen Free Extract Digestibility. SE: Standard error

5
 Table 2 shows the highest average digestibility of crude fiber, crude fat, and NFE in P2, P1, P0, and P3 treatments, respectively. Therefore, boiling mangrove leaves using husk ash water at a concentration of 15% (w / v) can improve the *In-vitro* crude fiber, crude fat, and NFE digestibility in the rumen during the digestion process.

The average digestibility value showed an increase in each treatment, with the highest value found in P2, which comprises of IV-CFD: 77.48%, IV-CFd : 31.80%, and IV-NFED 64.57%. [13] stated that digestibility was carried out to determine the nutrients that can be absorbed for maintenance, growth, and production. Therefore, the digestibility was affected by the feeding level, animal species, feed deficient, feed processing, combination of feed ingredients, and gastrointestinal disorders.

The highest value of IV-CFD in this study was 77.48%. This is because at 10 minutes the fiber components was not damaged, the leaves were not softened and the lignin content was decreased at that treatment. [14] stated when the leave was soaked for 24 hours and boiled for 90 minutes it reduced the composition of crude fiber. According to [15] the crude fiber digestibility was influenced by several factors, the composition of crude fiber and the rumen microorganism's activity.

The average result of the highest crude fat digestibility using husk ash water was 31.80%. This is because the absorbed fat in the treatment material contained triglycerides (simple fat). [16] reported that the high digestibility of crude fat is due to the chemical structure with the average value influenced by several factors. [17] stated that the factors that influence the digestibility value are the amount and content of nutrients in feed. Furthermore, [18] reported that the hydrolysis with husk ash water is more beneficial than other types of alkaline. It also has the ability to increase the nutritional value of feed by adding minerals contained in the ash and by increasing the consumption, digestibility, and palatability values.

The highest average yield of In-vitro Nitrogen Free Extract Digestibility (IV-NFED) was 64.57% due to the high starch content in the treatment. [19] stated that the high NFE content describes the easily digestible carbohydrate fraction such as starch and sugar. According to [20], NFE contains starch such as monosaccharides, trisaccharides, disaccharides, and polysaccharides that are acidic and alkaline with high digestibility. Naturally, BETN is digested more easily by microbes, with an increase in the number of bacteria, thereby, making it possible to maximally degrade complex compounds into simpler compounds.

At 15 minutes of boiling time (P3), there was a decrease in the In-vitro Crude Fiber Digestibility (IV-CFD) and IV-NFED due to the damage of feed substances caused by prolonged boiling time using husk ash water. This result showed that more nutrients are hydrolyzed and anti-nutrients are reattached to reduce digestibility. This is supported by research conducted by [21] which stated that prolonged heating damages and decreases several nutrient substances, including protein, vitamins, and fat. Sometimes, heating is desired in feed

1 The Effect of Boiling Mangrove (*Avicennia marina*) Leaves Onin-Vitro Nutrients Digestibility ..

processing, however, when it is prolonged, it becomes detrimental, therefore it needs to be prevented. Meanwhile, the lignin value in P3 treatment was high at 12.18% at an optimal limit of 7% with the rest capable of affecting digestibility. Lignin is a limiting factor in feed component digestibility that is resistant to chemical and enzymatic degradation. The higher the lignin contents in the ration, the lower the digestibility of a feed components [22].

Total Phenol and Total Tannin

Table 3 shown the significant effect ($P < 0.05$) of treatments on total phenol and tannin of mangrove leaves.

The variance results showed that boiling using husk ash water increases and decrease the total phenol of mangrove leaves. The average total phenol in P2 treatment was 99.29 mgMAE, with a decrease in value due to a prolonged heating time with husk ash water. According to [23] and [24], the decrease in total average phenol content occurs due to the unstable destructive effect on heating, which makes polyphenol compounds to be easily dissolved in boiling water. [25] stated that husk ash acts as a good absorbent, therefore it can absorb and bind polyphenol compounds.

Table 3. Average total phenol and tannin

Treatment	Total Phenol (mgGAE)	Total Tannin(%)
P0	79.11 ^c	11.10 ^b
P1	103.19 ^a	14.91 ^a
P2	99.29 ^b	10.27 ^c
P3	95.34 ^b	10.89 ^c
SE	0.62	0.33

7 Note: Different superscripts in the same column are significantly different ($P < 0.05$). SE: Standard error, P0 = 0 minutes, P1 = 5 minutes, P2 = 10 minutes and P3 = 15 minutes of boiling.

The tannin content at 5 minutes of boiling (P1) increased by 14.91% due to the combination of other secondary metabolites and other polyphenol compounds in initial heating process. [26] stated that at high temperatures, catechol oxidase enzyme becomes inactive with enzymatic reaction, thereby, leading to an increase in the tannin content.

In P2 treatment (10 minutes of boiling), the tannin content decreased by 10.27%. This is because a prolonged boiling process tends to loosen the bonds of mangrove leaves tissue which facilitates the osmosis process. Therefore, the tannins come out and dissolve in husk ash / alkaline water. After boiling, the mangrove leaves are soaked for a while in plain water, and during this period the diffusion process occurs. According to [27], diffusion occurs when the solution in the cell has a high concentration, therefore, the tannins in mangrove leaves dissolve in alkaline water.

Based on the average results, the tannins found in mangrove (*Avicennia marina*) leaves have been boiled tends to decrease compared to without boiling with high yield content. Tannins derived from forages are generally condensed and have stronger complex bonds with proteins compared to when it is hydrolyzed. According to [28] and [29], the strong bond between tannins and protein affect on protein digestibility. [30] stated that the condensed tannins are polymers of flavonoid compounds with carbon-carbon bonds in the form of catechin and galocatechin.

3 IV. CONCLUSION

The results of the experiment showed that the best boiling time for mangrove leaves (*Avicennia marina*) was P2 (10 minutes boiling), with an average of IV-CFD (77.48%), IV-CfD (31.80%), and IV-NFED (64.57%). It also showed a decrease in the value of total phenol and tannin of 99.29 mg GAE, and 10.27%, respectively.

V. RECOMMENDATION

Further research needs to be carried out by making complete rations for goats based on mangrove leaves (*Avicennia marina*) in *in-vivo* methods.

8 ACKNOWLEDGMENTS

The authors are grateful to the Directorate of Research and Community Service, Ministry of Research and Technology/National Research and Innovation Agency (BRIN) for Fiscal Year 2020.

REFERENCES

- [1]. (Siregar, 2003). Siregar, S.B. 2003. Ransum Temak Ruminansia. Penebar Swadaya. Jakarta.
- [2]. Giri, C. Ochieng, E. Tieszen, L. L., Zhu, Z. Singh, A., Loveland, T. Duke, N. 2011. Status and distribution of mangrove forests of the world using earth observation satellite data. *Global Ecology and Biogeography*, 20 (1): 154-159.
- [3]. Noontji, A. 2005. Laut Nusantara. Djambatan. Jakarta. Indonesia.

- [4]. Wibowo, C. Cecep Kusmana, Ani Suryani, Yekti Hartati dan Poppy Oktadiyani. 2009. Pemanfaatan Pohon Mangrove Api-api (*Avicennia* sp) Sebagai Bahan Pangan dan Obat. IPB, Bogor. Hlm:160-165.
- [5]. Takarina, N. D., & Patria, M. P. (2017). Content of polyphenol compound in mangrove and macroalga extracts. International Symposium on Current Progress in Mathematics and Sciences 2016 (ISCPMS 2016) doi:10.1063/1.4991204
- [6]. Tilley, J. M. A dan R. A. Terry. 1963. A Two Stage Technique for the In vitro Digestion of Forage Crops. Journal of British Grassland 18 : 104 – 111.
- [7]. AOAC (1999)[8]. *Official Method of Analysis of The Association of Official Analytical of Chemist*. Arlington: The Association of Official Analytical Chemist, Inc.
- [8]. Purnama, R. (2015). Aktivitas antioksidan, kandungan total fenol, dan flavonoid lima tanaman hutan yang berpotensi sebagai obat alami. (Skripsi Sarjana). Institut Pertanian Bogor.
- [9]. Broadhurst, R.B. dan Jones, W.T. (1978). Analysis of condensed tannin using acified vanillin. Journal of Science, Food and Agricultural 29: 788-794.
- [10]. Anwa EP, Auta J, Abudullahi SA, Bolorunduro PI. 2007. Effect of processing on seeds of *Albizia lebbek*: Proximate analysis and phytochemical screening. Res. J. Bio Sci. Vol 2(1):41-44.
- [11]. Nsa, EE, Ukachukwu, SN, Isika, MA, and Ozung, PO. 2011. Effect of boiling and soaking durations on the proximate composition, ricin and mineral contents of undecorticated castor oil seeds (*Ricinus communis*). International Journal of Plant, Animal and Environment Sciences. Vol 1(3) : 244-252
- [12]. Sukaryana, Y., U. Atmomarsono, V. D. Yuniarto dan E. Suprijatna. 2011. Peningkatan nilai kecernaan protein kasar dan lemak kasar produk fermentasi campuran bungkil inti sawit dan dedak pagi pada broiler. JITP. 1 (3) : 167-172.
- [13]. Udensi, EA., NU, Anisa. E. Ikpa. Effects of soaking and boiling and autoclaving on the nutritional quality of *Mucuna Flagelli pes* ("ukpo"). African Journal of Biochemistry Research. 2010; 4 (2) : 47-50.
- [14]. Maynard, L.A. Loosil, J.K. Hintz, H.F and Warner, R.G. 2005. Animal Nutrition. 7th Edition McGraw-Hill Book Company. New York, USA.
- [15]. Wiseman, G. 2002. Nutrition and Health. London: Taylor dan Francis.
- [16]. Paramita, w., w.e.Susanto dan A.B.Yulianto.2008. Konsumsi dan kecernaan bahan kering dan bahan organik dalam beylase pakan lengkap temak sapi Peranakan Ongole. Media Kedokteran Hewan, 24(1):59-62.
- [17]. Hartati. 2000. Pengaruh Lama Perendaman Tandan Kosong Sawit dengan Air Abu Sekam terhadap Kandungan NDF, ADF, Hemiselulosa dan PK. Skripsi Fakultas Peternakan Unand. Padang.
- [18]. Tillman, A. D., H. Hartadi, S. Reksohadiprojo, S. Prawirokusumo, L. Lebdoeokojo. 1998; dalam Riswandi *et al.*, 2016. Ilmu Makanan Ternak Dasar. Gajah Mada University Press. Yogyakarta.
- [19]. Anwar K. 2008. Kombinasi Limbah Pertanian dan Peternakan Sebagai Alternatif Pembuatan Pupuk Organik Cair Melalui Proses Fermentasi Anaerob. Yogyakarta: UII ISBN:978-979-3980-15-7
- [20]. Bird, T. 1987. Kimia Fisik Untuk Universitas. Penerbit PT. Gramedia. Jakarta. Hal 54-55.
- [21]. Tilman, A. D., H. Hartadi, S. Reksohadiprojo, S., Prawirokusumo, L. Lebdoeokojo. 1991. Ilmu dan Makanan Ternak Dasar. Cetakan Ke-6. Gajah Mada University Press. Yogyakarta.
- [22]. Saika S, Mahanta CL. 2013. Effect of steaming, boiling, and microwave cooking on the and antioxidant activities of four *Boletus* mushrooms. J Food Sci Tech, 51(11):3362-3368
- [23]. Sun et al. (2012). Sun L, Bai X, Zhuang Y. 2012. Effect of different cooking methods on total phenolic contents.
- [24]. Sembodo (2005) Sembodo B. 2005. Isoterm Kesetimbangan Adsorpsi Timbal pada Abu Sekam Padi. Jurusan Teknik Kimia, Fakultas Teknik, UNS. Solo. IV(4) : 100-105.
- [25]. Muhammad, P . H., L. P. Wrasisati, Anggreni, A. A. M., 2015. Pengaruh suhu dan Lama Curing Terhadap Kandungan Senyawa Bioaktif Ekstrak Etanol Bunga Kecembrang (*Nicolaia speciosa* Horan). Jurnal Rekayasa dan Manajemen Agroindustri, 3 (4): 92-102.
- [26]. Danarto, Y. C. 2008. Pirolisis Sekam Padi dengan Katalisator Zeolit. Prosiding Seminar Nasional Kimia dan Pendidikan Kimia, FMIPA dan UNS.
- [27]. Fahey, G. C., dan L. L. Berger. 1988. Carbohydrate nutrition of ruminants. In : D. C Chruch (Ed). Digestive Physiology and Nutrition of Ruminants. The Ruminant Animal. Prentice Hall Eglewood Cliifs, New Jersey. Fakultas MIPA UNM: Malang.
- [28]. Mueller, H. I. 2006. Unravelling the Conundrum of Tannis in Animal Nutrition and Health. J. Sci. Food. Agric. 86 : 2010-2037.
- [29]. Patra, A. Kand J. Saxena. 2010. Anew perspective on the use of plant secondary metabolites to inhibit methanogenesis in the rumen. J. Phytochemistry. 71: 1198–1222.

Novirman Jamarun, et. al. "The Effect of Boiling Mangrove (*Avicennia marina*) Leaves Onin-Vitro Nutrients Digestibility and Tannin Content as Animal Feed." *Quest Journal of Research in Agriculture and Animal Science*, vol. 07, no. 03, 2020, pp. 01-05.

The Effect of Boiling Mangrove (*Avicennia marina*) Leaves OninVitro Nutrients Digestibility and Tannin Content as Animal Feed

ORIGINALITY REPORT

20%
SIMILARITY INDEX

15%
INTERNET SOURCES

14%
PUBLICATIONS

3%
STUDENT PAPERS

PRIMARY SOURCES

1 www.semanticscholar.org **5%**
Internet Source

2 N Jamarun, R Pazla, G Yanti. "Effect of boiling on in-vitro nutrients digestibility, rumen fluid characteristics, and tannin content of mangrove (*Avicennia marina*) leaves as animal feed", IOP Conference Series: Earth and Environmental Science, 2021 **3%**
Publication

3 repo.unand.ac.id **3%**
Internet Source

4 R W W Sari, N Jamarun, Arief, R Pazla, G Yanti, Z Ikhlas. "Nutritional Analysis of Mangrove Leaves (*Rhizophora apiculata*) Soaking with Lime Water for Ruminants Feed", IOP Conference Series: Earth and Environmental Science, 2022 **2%**
Publication

5	Internet Source	2%
6	questjournals.org Internet Source	1%
7	repository.untad.ac.id Internet Source	1%
8	www.growingscience.com Internet Source	1%
9	Submitted to Universitas Brawijaya Student Paper	1%
10	Mardiati Zain, Rusmana W S Ningrat, Erpomen, Ezi Masdia Putri, Malik Makmur. " The effects of leguminous supplementation on ammoniated rice straw based completed feed on nutrient digestibility on microbial protein synthesis ", IOP Conference Series: Earth and Environmental Science, 2019 Publication	1%
11	repository.unja.ac.id Internet Source	1%

Exclude quotes Off
Exclude bibliography On

Exclude matches < 1%

The Effect of Boiling Mangrove (*Avicennia marina*) Leaves On *In Vitro* Nutrients Digestibility and Tannin Content as Animal Feed

PAGE 1

PAGE 2

PAGE 3

PAGE 4

PAGE 5
