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The Effect of Adding Batak Onion (*Allium chinense* G. Don) to Drinking Water on Digestibility in Broiler Chickens

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ABSTRACT

Indonesia population growth has driven an increase in the demand for chicken meat.This study aimed to determine the effect of adding Batak onion (Allium chinense G.Don) decoction to drinking water on feed intake and digestibility of dry matter and organic matter in broiler chickens and mortality. The research was conducted experimentally using a Completely Randomized Design (CRD) with four treatments: T0 (without Batak onion), T1 (15%), T2 (20%), and T3 (25%), each with five replications. The results showed that the addition of Batak onion decoction has no significantly affected (P>0.05) on on dry matter intake, dry matter digestibility, organic matter digestibility, or mortality. However, digestibility values remained within optimal ranges and there is no mortality compare to treatment without Batak onion. The best treatment was found at the 15% concentration, which resulted in the highest dry matter intake. The addition of Batak onion in drinking water shows potential as a natural alternative to improve digestive efficiency in broiler chickens.

Keyword: batak onion, broiler chickens, drinking water, digestibility, feed intake

1. Introduction

Meat, as one of the primary sources of animal protein in Indonesia, has experienced a significant increase in demand in recent years, making it an essential commodity for many people. Chicken meat, in particular, represents a key staple that must be further developed to meet the growing need for animal protein consumption. The continuous growth of Indonesia's population has contributed to a rising demand for poultry meat, especially broiler chicken, which is currently the most preferred type of poultry.

According to data from the National Food Agency, per capita consumption of broiler chicken has shown a consistent annual increase. Consumption levels reached 6.04 kg in 2020, 6.55 kg in 2021, 7.15 kg in 2022, and 7.46 kg in 2023. In total, chicken meat consumption for protein needs in 2023 amounted to approximately 2.08 million tons per year.

Broiler chickens serve as an accessible and affordable source of animal protein for the community. The quality of broiler meat is strongly influenced by digestive processes, which depend on feed nutrients and the metabolic activity within the animal [1]. Optimal growth in broilers is largely determined by the quality of feed consumed. High-quality feed promotes efficient nutrient absorption in the digestive tract, leading to improved performance.

Traditionally, antibiotics have been widely used by farmers as growth promoters in poultry production. These antibiotics function by suppressing pathogenic microorganisms in the digestive tract, allowing beneficial microbes to dominate and enhance nutrient digestibility [2]. However, the use of antibiotics in animal feed has been increasingly reduced due to concerns over antibiotic residues in animal products and the emergence of

antibiotic-resistant pathogenic bacteria. These issues raise significant concerns among poultry farmers, as they may increase the risk of infectious diseases in chickens. Consequently, farmers have begun to explore alternative approaches using natural feed additives [3].

In North Sumatra, there is a wide availability of natural resources that can be utilized as feed additives. One such resource is Batak onion (*Allium chinense* G. Don), a plant commonly found in the region with considerable potential to improve feed quality in poultry. Batak onion contains approximately 87.9 g of water, 8.0 g of carbohydrates, 1.6 g of protein, and 1.2 g of cellulose. In addition, it is rich in minerals such as magnesium and calcium, as well as vitamin C [4]. It also contains bioactive compounds, including flavonoids, triterpenoids, steroids, and saponins [5], which exhibit antibacterial properties. Traditionally, onions have been widely used for their antimicrobial and antifungal effects. Furthermore, Batak onion has the potential to enhance the digestive capacity of the gastrointestinal tract, thereby improving nutrient digestion and absorption [6].

Batak onion shares similar bioactive components with other *Allium* species. The presence of flavonoids and saponins contributes to its antioxidant activity, which plays an important role in maintaining gut health and optimizing nutrient digestion [7]. The inclusion of saponins in drinking water has been reported to improve feed digestion in the gastrointestinal tract, thereby increasing digestibility values, including dry matter and organic matter digestibility [8]. Based on these considerations, further research is necessary to evaluate the effect of administering Batak onion (*Allium chinense* G. Don) in drinking water on feed intake and digestibility in broiler chickens.

2. Materials and Methods

2.1. Research Methods

This research was conducted experimentally using a completely randomized design (CRD) consisting of four treatments and three replications. The treatments were as follows:

T0 : Drinking water without boiled onion water
T1 : Drinking water with the addition of 15% boiled onion water
T2 : Drinking water with the addition of 20% boiled water from onion
T3 : Drinking water with the addition of 25% boiled onion water

2.2. Experimental Animals and Equipment

The initial stage of the research was the preparation phase, which included the preparation of the cages, maintenance equipment, and vaccination. 100 broiler chickens were placed in experimental cages lined with wood husks and newspaper. The broilers were divided into 20 flocks, each containing five chickens. The cages were provided with *feeder*, a drinking bowl, a 30-watt incandescent lamp, a thermometer, and a hygrometer to measure the temperature and humidity of the coop. When raising broiler chickens, the temperature inside the coop must be maintained and ventilation must be adequate. The coop and maintenance equipment must be kept clean until the research is complete. When the DOCs are first introduced to the coop, they are given brown sugar water as an energy boost to prevent stress. This sugar water is provided the first week before treatment.

To prevent the spread of disease, chickens are vaccinated. The vaccines used are Newcastle Disease (ND) and Gumboro A, for 100 broiler chickens. The Newcastle Disease (ND) vaccine is administered in the eyes of four-day-old chickens in the morning to ensure optimal effectiveness. The Gumboro A vaccine is administered in the drinking water of 21-day-old chickens to reduce mortality in broiler chickens.

Giving The treatment was carried out for four weeks, starting from week 2 to week 5. Treatment was given daily in the morning at 7:00 a.m. Once the drinking water supply was depleted, regular water was provided ad libitum. The drinking water requirements for broiler chickens during the rearing period are as follows:

Tabel 1. Drinking water requirements for broiler chickens

Age	Drinking water requirements (ml/bird/week)
0-7 Days	65
8-14 Days	120
15-21 Days	180
22-28 Days	245
29-35 Days	330

2.3. Treatment Making Process

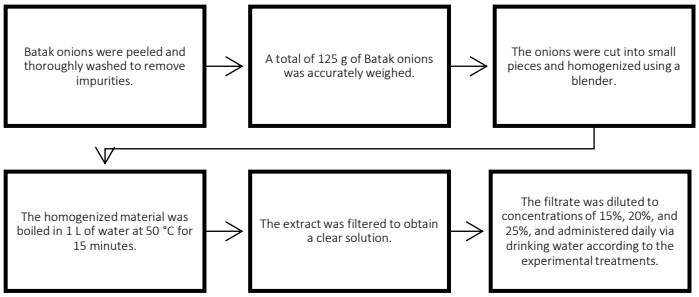


Figure 1. The Process of making batak onion stew

2.3. Sampling Technique

Five-week-old broiler chickens were randomly selected and moved into individual cages of 12. The prepared cages were equipped with a feces collection tray at the bottom.

The implementation stage of feces collection using the method [9] was carried out for 3 days. After the chickens were transferred to individual cages, they were fasted for 24 hours, but drinking water was still provided. After 24 hours of fasting, the chickens were fed 100 g/head/day and if the feed ran out, another 100 grams would be added. Then, feces were collected in a prepared place. Chicken feathers that entered the feces were cleaned. Feces were collected after being fed for 24 hours. Total feces collection was carried out the next day. Then, the collected feces were weighed for fresh weight and dry weight after being dried in the sun. The total dry feces collection was weighed and a sample of 50 grams was taken from the total feces each day, then homogenized and put into plastic, tied and labeled according to treatment.

Feed sampling was conducted once during the total collection, taking 100 grams of the initial feed given. If there was any remaining feed, it was weighed each morning, and a subsample of approximately 10 grams was collected and placed in a plastic bag. The feed samples were subjected to proximate analysis, namely dry matter (DM) and organic matter (OM).

2.4. Variables

1. Dry matter intake, expressed in grams per head per day (g/bird/day), is calculated by subtracting the total feed provided from the daily feed intake. The following formula can be used to calculate the total dry matter and organic matter intake.

Dry Matter Intake (g/bird/day) = (Feed offered- Feed refusal)x Dry matter (%)

Organic Matter Intake (g/bird/day) = Dry Matter Intake (g) x Organic matter (%)

2. Dry matter digestibility is measured by subtracting the dry matter from the amount of manure, dividing by the dry matter intake, and multiplying by 100%. Dry matter intake is calculated by multiplying the dry matter intake by the ration intake. Dry matter digestibility can be calculated using the following formula:

$$\text{DMD (\%)} : \frac{\text{Dry Matter Intake} - \text{Fecal Dry Matter Output (feses)}}{\text{Dry Matter Intake}} \text{ x } 100$$

3. The organic matter digestibility value is calculated by dividing the organic matter consumption by the amount of fecal organic matter by the organic matter consumption and then multiplying by 100%. Organic matter consumption can be calculated by multiplying the dry matter content of the ration by the organic matter content of the ration. Organic matter digestibility is calculated using the following formula.

$$\text{OMD (\%)} : \frac{\text{Organic Matter Intake} - \text{Fecal Organic Matter Output (feses)}}{\text{Organic Matter Intake}} \text{ x } 100$$

4. Mortality can be calculated by comparing the total number of chickens that died during the study with the number of chickens raised at the beginning of the study. The mortality percentage is calculated by multiplying the initial number of chickens by 100 percent [10] using the following formula:

$$\text{Mortality (\%)} = \frac{\text{Total number of dead birds}}{\text{Initial number of birds}} \text{ x } 100$$

2.5. Data Analysis

The data obtained will be analyzed using mathematical statistical methods.*Analysis Of Variance* (ANOVA). If the results show a significant difference between the treatments, further testing will be carried out using a multiple range test.*Duncan's (Duncan's Multiple Range).*

3. Result and Discussion

3.1. Dry Matter Intake

Table 2. Average Dry Matter Intake (g/bird/day)

Treatment	Replication			Mean ± SD
	1	2	3	
T0	158, 42	162, 00	162,89	$161,10^{ns} \pm 2,38$
T1	170,10	154,80	179,00	$167,97^{ns} \pm 12,24$
T2	156,60	174,50	162,00	$164,36^{ns} \pm 9,18$
T3	157,50	162,90	161,10	$160,50^{ns} \pm 2,74$

Description: ns = no significant difference between treatments (P>0.05)

The results of this study are superior to those of previous research by [11], which found that adding 25% boiled water from herbs such as garlic and galangal reduced feed intake. [12] study found that adding herbs such as red ginger, galangal, shallots, and garlic to broiler chicken drinking water reduced feed intake. This was due to the presence of secondary compounds, including saponins and tannins, which have a bitter taste, thus reducing palatability.

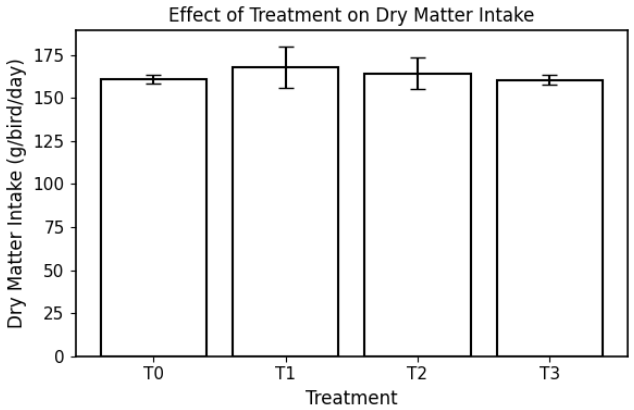


Figure 2. Dry Matter Intake

Different from previous research, in this study the statistical results showed no real difference in each treatment which can be confirmed that giving boiled Batak onions to chicken drinking water does not affect the dry matter consumption value or in other words, there is no disturbing taste that reduces the chicken's appetite.

The absence of significant differences among treatments suggests that the inclusion of boiled Batak onion in drinking water is physiologically safe and does not alter feeding behavior. This may indicate that the concentration of bioactive compounds used in this study is within the tolerable range for broiler chickens, allowing normal feed consumption without adverse sensory effects.

3.2. Dry Matter Digestibility

Table 3. Average Dry Matter Digestibility (%)

Treatment	Replication			Mean ± SD
	1	2	3	
T0	70,72	79,06	83,71	77,83^{ns} ± 6,58
T1	77,54	66,04	70,31	71,30^{ns} ± 5,81
T2	82,67	79,11	68,43	76,74^{ns} ± 7,41
T3	74,36	59,56	70,48	68,13^{ns} ± 7,67

Description: ns = no significant difference between treatments (P>0.05)

Numerically, treatment T2 showed a relatively higher KcBK value than T1 and T3. This indicates that at a certain dose level, the bioactive compounds in Batak onion are thought to be at an optimal level to support digestion. However, this increase was not strong enough to produce a statistically significant difference.

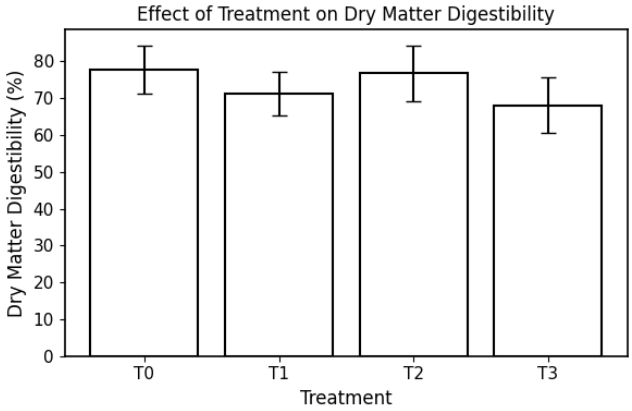


Figure 3. Dry Matter Digestibility

The dry matter digestibility values obtained in this study were still within the normal range for finisher broiler chickens, namely 50%–80% as reported by [13], [14]. However, this value was relatively lower than the results of the study by [15] who reported a KcBK of 76.26%–77.96% when using fish meal. This difference may be caused by the form of feed administration, where in that study used solid ingredients, while in this study Batak onion was given in boiled (liquid) form.

Liquid forms are thought to accelerate digesta flow through the digestive tract, shortening the contact time between active compounds such as flavonoids and saponins and the digestive system. This aligns with [16] finding that liquid materials tend to have a faster transition rate than solids in the digestive tract.

The low digestibility value in the T3 treatment is thought to be related to the increased concentration of antinutritional compounds such as tannins and saponins, which can reduce palatability and disrupt the digestive process if given in excessive amounts [8]. Conversely, in the T2 treatment, the dosage administered is thought to be at a more appropriate level, thus minimizing the negative effects of antinutritional compounds and optimizing the activity of bioactive compounds.

3.3. Organic Matter Digestibility

Table 4. Average Digestibility of Organic Matter (%)

Treatment	Replication			Mean ± SD
	1	2	3	
T0	74,14	81,77	85,98	80,63^{ns} ± 6,00
T1	72,15	71,02	73,11	72,09^{ns} ± 1,05
T2	84,38	74,92	74,50	77,93^{ns} ± 5,58
T3	77,23	58,33	80,18	71,92^{ns} ± 11,85

Description: ns = no significant difference between treatments (P>0.05)

The digestibility level of 15%, 20%, and 25% of the drinking water provided showed that the administration of Batak onion was able to maintain the level of dry matter digestibility of broiler chickens at an optimal level. The results of the organic matter digestibility value showed that the T2 treatment with the administration of 66 ml of Batak onion boiled water from the drinking water requirement had the best results compared to the T1 and T2 treatments.

The results of this study showed a range of optimal and relatively similar levels of organic matter digestibility. This is due to the same feed intake in each treatment, resulting in consistent nutrient availability. Although there were no differences between treatments, there was a tendency that increasing the concentration of Batak onion extract in drinking water had a positive effect on the chickens' ability to maintain their ability to digest organic matter in the ration. The results of this study are relatively similar to those of [17] the addition of moringa leaf extract containing bioactive compounds such as flavonoids can maintain the digestibility of organic matter at around 71% - 75% and [18] research by administering beluntas extract containing active substances (flavonoids) to broiler chickens has not been able to increase the digestibility of organic matter but still maintains the digestibility of organic matter at a normal level of around 78 - 82%. This is due to the content of active compounds such as flavonoids and saponins which are able to support the activity of digestive enzymes and maintain the stability of intestinal microflora [19].

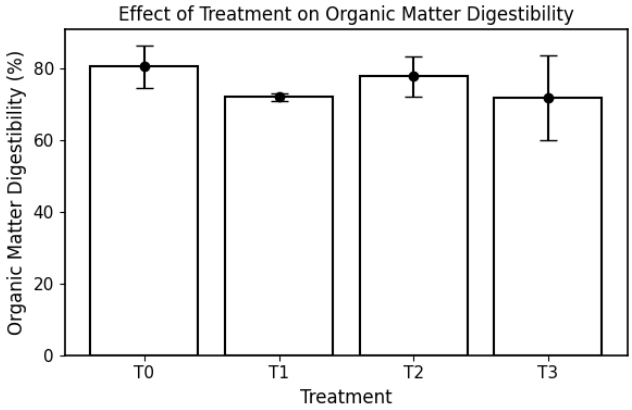


Figure 4. Organic Matter Digestibility

The increase in organic matter digestibility at T2 can be attributed to the high dry matter digestibility obtained in this study, thus directly impacting the organic matter digestibility. This is in line with [20] who stated that organic matter digestibility is greatly influenced by the value of dry matter digestibility, because dry matter contains organic and inorganic materials. When compared with the T0 treatment which had an average organic matter digestibility of 80.63%, the T3 treatment showed a decrease of 71.91%. This decrease was caused by the administration of boiled Batak onion water which tasted bitter in the chicken's mouth so that it could reduce the level of palatability and consumption of organic matter. This low level of organic matter digestibility is also in line with the decrease in the dry matter digestibility obtained in this study as stated by [21] that the consumption value of organic matter is always in line with the consumption value of dry matter.

3.4. Mortality

Tabel.5 Average of Mortality (%)

Treatment	Replication			
	T0	T1	T2	T3
Mortality (%)	$0{,}08^{ns}$ ±0,02	0^{ns}±0	0^{ns}±0	0^{ns}±0

Description: ns = no significant difference between treatments (P>0.05)

The mortality rate observed during the study was very low, with only 0.08% recorded in treatment T0, while treatments T1, T2, and T3 showed no mortality (0%). According to [22], acceptable mortality in well-managed broiler production should not exceed 4%. Therefore, the mortality levels observed in this study were far below the critical threshold, indicating good health status and proper management across all treatments.

The absence of mortality in most treatments suggests that supplementation of boiled Batak onion (*Allium chinense*) in drinking water did not negatively affect broiler survival. Instead, it may have contributed to maintaining physiological stability and optimal health conditions in birds.

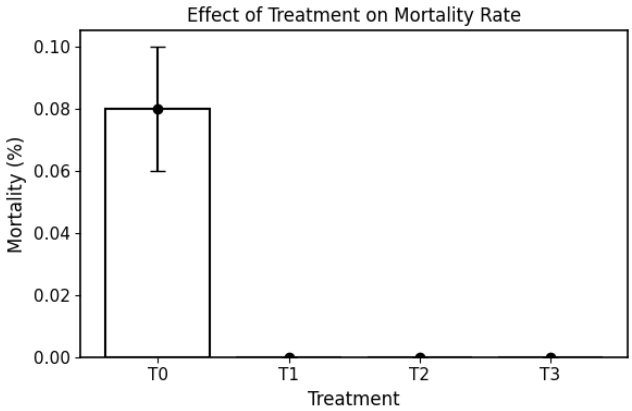


Figure 5. Mortality

This condition is likely associated with the presence of bioactive compounds in Batak onion, particularly flavonoids, which function as natural antioxidants and antimicrobial agents. Flavonoids are known to neutralize free radicals, thereby reducing oxidative stress and enhancing immune responses in poultry. As a result, chickens become more resistant to pathogenic infections that may affect vital organs.

This finding is consistent with [23], who reported that flavonoids play an important role in improving immunity in broiler chickens by scavenging free radicals and protecting body tissues from oxidative damage. In addition, [24] stated that flavonoids act as antioxidants that become particularly active under conditions of physiological stress or when endogenous antioxidant enzyme activity is compromised.

3.5. Correlation Between Parameters

Tabel.6 Correlation Between Parameters

Parameters	Correlation coefficient (r)	P-value
Dry Matter Intake vs Dry Matter Digestibility	0.04	0.96 (ns)
Dry Matter Intake vs Organic Matter Digestibility	0.36	0.64 (ns)
Dry Matter Intake vs Mortality	-0.66	0.34 (ns)
Dry Matter Digestibility vs Organic Matter Digestibility	0.21	0.79 (ns)
Dry Matter Digestibility vs Mortality	-0.39	0.61 (ns)
Organic Matter Digestibility vs Mortality	-0.55	0.45 (ns)

Based on the results of the correlation analysis between parameters, no significant relationship ($P > 0.05$) was found between dry matter consumption, dry matter digestibility, organic matter digestibility, and mortality. This indicates that changes in one parameter do not directly affect the other parameters under the conditions of this study.

However, there is a tendency for a positive correlation between dry matter consumption and organic matter digestibility, which indicates that increased consumption tends to be followed by increased nutrient utilization efficiency, although this is not statistically significant.

The negative correlation value between mortality and nutritional parameters indicates that increasing consumption quality and digestibility tends to be associated with reduced mortality, but this relationship is weak and not significant.

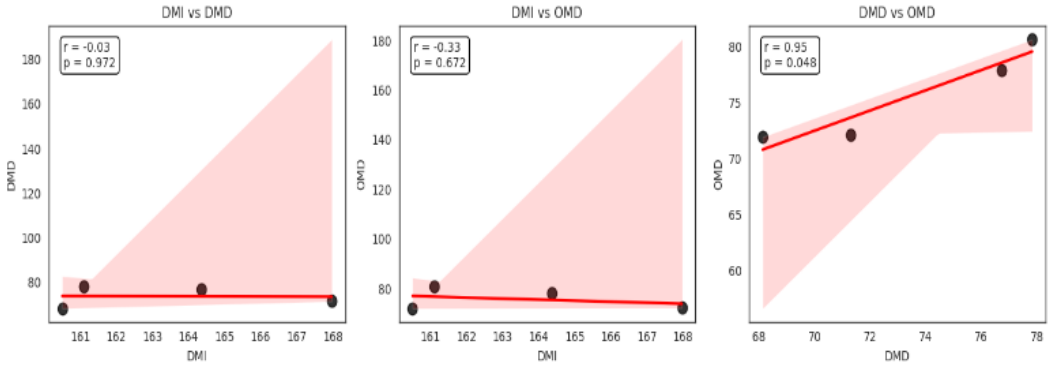


Figure 6. Correlation Between Parameters

4. Conclusion

Adding boiled Batak onion to broiler chickens' drinking water had no effect on dry matter intake, dry matter digestibility, organic matter digestibility, or mortality. Statistically, adding Batak onion to broiler chickens' drinking water showed no effect, but numerically, it maintained dry matter and organic matter digestibility at normal levels and reduced mortality.

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