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**Submission date:** 23-May-2023 02:12PM (UTC+0700)
**Submission ID:** 2099888564
**File name:** PENELITIAN_8.pdf (392.98K)
**Word count:** 1981
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# Buffalo is more environmentally friendly than cattle based on N excretion



IOP Conf. Series: Earth and Environmental Science **247** (2019) 012050 doi:10.1088/1755-1315/247/1/012050

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# Buffalo is more environmentally friendly than cattle based on N excretion

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**Abstract.** Cattle and buffalo have different characteristic in utilizing of feed protein. The differences of utilization will impact on N excretion in feces and urine which are potential to increase environmental contamination. Therefore, it was necessary to evaluate the N emission factor and to determine the specific management that suitable for each commodity species. Total of 26 individual data were obtained from 2 studies in nitrogen balance trials (11 heads of cattle and 15 heads of buffalo). All data were observed from total collection method. The value of nitrogen content in feces and urine were analyzed by Kjedhal method. The parameters observed in this study were nitrogen intake, nitrogen faeces and urine. The data were analyzed using t-test. The results showed that higher N intake/metabolic BW, the higher N excretion, both of urine and feces on buffalo and cattle. In the same intake/metabolic BW, buffalo excreted higher feces than cattle. However, different result was shown in N urine excretion. N urine excretion on buffalo was lower than cattle. N intake/metabolic BW has positive and strong correlation with all N feces excretion (r = 0.89) but low correlation with all N urine excretion (r = 0.36). It can be concluded that buffalo was more environmentally friendly than cattle due to lower nitrogen urine excretion.

## 1. Introduction

Livestock has an important role in providing the animal protein needed. On the other hand, they also produce manure that has negative impact to the environment [1]. Nitrogen contained in feces and urine of livestock is one source of environmental pollution. [2] stated that 5-30% N in livestock waste is N volatile. As [3] and [4] stated that 50-90% N excreted is volatilized into the atmosphere in the form of ammonia or nitrogen gas, or is lost by seeping or flowing. The volatilized nitrogen will turn into nitrate [5]. Then, rain will return nitrate to the soil, known as acid rain. If water contaminated by nitrate is consumed, it can cause disease. Therefore, the amount of nitrogen output needs to be considered.

The amount of nitrogen output is influenced by the ability of livestock to utilize the feed consumed. The greater the utilization of feed, the smaller the N is wasted. Feed utilization ability is affected by breed [6]. Both of cattle and buffalo are suitable to be raised in tropical country. [7] reported that daily nutrient requirement of cattle to maintenance about 167 g CP and 90 g protein digestibility, while buffalo about 163 g CP and 80 g protein digestibility. It means that different breed will have different feed utilization abilities. So it is necessary to evaluate the correlation between N intake and N output on different breed.

Since, nitrogen output causing negative impacts, thus further action is needed to decrease nitrogen contamination. It is can be done by building the national inventory data on nitrogen output. This paper is expected to support the national inventory data of nitrogen output.

## 2. Materials and methods

### *2.1 Animals*

This study was used fifteen heads of buffalo aged 6 month with average body weight amount 109.43 ± 16.62 kg (CV: 15.19%) and eleven heads of cattle aged 1-2 years old with average body weight about 154 ± 11.61 kg (CV: 7.54%). The feed offered were formulated to fulfill the nutrients requirements for maintenance and for production (daily gain).

### *2.2 Sampling method*

The parameters observed in this study were nitrogen intake, nitrogen faeces and urine. The nutrient intake was measured based on the differences between the feed offered and residual feed, multiplied by the nitrogen content of feed. The data of nitrogen feces and urine were observed from total collection method. Total collection was done by collecting feces and urine. Total collection was done every day for 7 days; begin at 08:00 until 08:00 the next day. Feces collected were sprayed with 20% $H_2SO_4$, placed into the plastic bag and stored in 16$^0$C cooled room. For total urine collection, a harness was fixed around the penis of each animal with elastic belts, the harness connected on container that contained 100 ml 20% $H_2SO_4$ solution to maintain the Ph <2.5. All 7 day collection, feces and urine were blended and homogenized and were sampled for 20 g, respectively. Then, this sample was analyzed to determine chemical composition of feces and urine. The value of nitrogen content in feces and urine were analyzed by Kjedhal method.

In order to avoid refraction due to differences in body weight and the breed that affect on physiological livestock, the data on consumption of nitrogen was made per metabolic body weight ($W^{0.75}$).

### *2.3 Statistical analyses*

The correlation of nitrogen intake/metabolic body weight and nitrogen excretion was analyzed using linier regression. The strength of correlation was analyzed by one-way ANOVA.

## 3. Results and discussion

Figure 1 showed that the higher N intake/metabolic BW, the higher N excretion, both of urine and feces on buffalo and cattle. In the same intake/metabolic BW, buffalo excreted higher feces than cattle. However, different result was shown in N urine excretion. N urine excretion on buffalo was lower than cattle. This indicated that buffalo can utilize the feed intake well. This was due to buffaloes have the ability to recycle nitrogen to the rumen [8, 9] higher than cattle [10]. [11] stated that as soon as rumen is developed in buffalo, purine derivate (PD) is recycled to the rumen and their PD excretion is about one third of that from cattle calves, it could be due to differences in glomerular filtration rate (GFR) or in permeability from blood to rumen. Therefore, it is making them more adaptable than cattle to conditions with low N in feed resources.

The result shows that N intake/metabolic BW has positive and strong correlation with all N feces excretion (r = 0.89). On the other hand, N intake/metabolic BW has positive but low correlation with all N urine excretion (r = 0.36) (table 1). This is due to feed intake affects on rumen out flow rate [12,13,14], while it will affect feed digestibility, as a determinant of the amount of feces excreted. Besides that, urine is the residual metabolism, so the amount of urine output is more influenced by the ability of animals to metabolize feed. Therefore, N intake/metabolic BW are more influence on feces excretion than urine excretion.

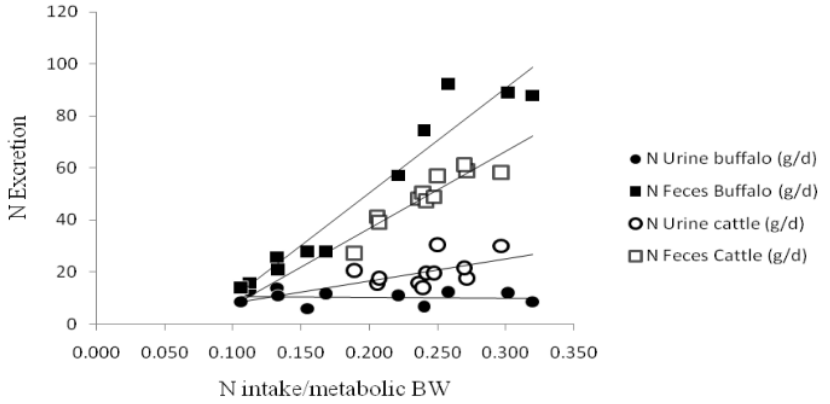


**Figure 1**. Graph of correlation N intake/metabolic BW and N excretion

**Table 1.** Correlation between N intake/metabolic BW and N excretion on different breed.

| Parameter | r | $R^2$ | Equation | P value | RSD |
|---|---|---|---|---|---|
| N Urine Buffalo (g/d) | 0.105 | 0.011 | y = -3.554x + 11.07 | 0.758 | 0.284 |
| N Urine Cattle (g/d) | 0.494 | 0.245 | y = 85.44x – 0.491 | 0.121 | 2.488 |
| All N Urine (g/d) | 0.368 | 0.136 | y = 38.88x + 6.761 | 0.091 | 2.287 |
| N Feces Buffalo (g/d) | 0.966 | 0.935 | y = 404.0x – 30.39 | 0.000 | 8.261 |
| N Feces Cattle (g/d) | 0.922 | 0.851 | y = 296.2x – 22.45 | 0.000 | 3.833 |
| All N Feces (g/d) | 0.89 | 0.793 | y = 333.5x – 24.03 | 0.000 | 9.601 |

## 4. Conclusion

Based from the results, it can be concluded that buffalo was more environmentally friendly than cattle due to lower nitrogen urine excretion.

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