Early growing performance of local male weaning lambs fed edamame pod-based rations with and without exogenous enzyme additives

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Abstract. This study aimed to evaluate the early growing performance of local male weaning lambs fed edamame pod-based rations with and without exogenous enzyme additives.Nine local male weaning lambs with initial weight about 16.88±2.33 kg/head were randomly assigned into into 3 levels treatment using an experimental completely randomized design (CRD). Every single level treatment was repeated 3 times. The levels treatment was 0% (control), 0.14% (w/w), and 0.28% (w/w) of exogenous enzyme addition into edamame pod-based rations. The lambs were maintained in individual pen which fed and given drinking water ad libitum. The parameters observed were nutrients consumption, liveweight gain, and gain to feed ratio during the first couple week maintenance with 2 weeks adaptation period. Data obtained were analysis using analysis of variance and further tested by DMRT for different result. The result presented that nutrient consumption, daily gain and gain to feed ratio were not affected (P>0.05) by various levels of exogenous enzyme additions. Thereby, it was concluded that the addition of exogenous enzyme up to 0.28% w/w potentially improved the nutrient consumptions and productivity performance of local male weaning lambs.

1. Introduction

*Glycine max* (L) Merill or edamame has been industrially produced and exported by Jember Regency. It also produced industrial waste around 10-15 tons of edamame pod waste every day. The potential of edamame pod waste (EPW) as an alternative local feed has been applied to beef and dairy cattle. However, this potential needs to be explored in order to optimize the use of EPW as sheep feed to support one of the Corporate Social Responsibility (CSR) programs for small-scale sheep breeders especially around Jember Regency.

The EPW was as a source of fiber with a crude fiber (CF) content of 33.93%; NDF 63.83%; ADF 43.10%; and 5.05% lignin but contain higher protein (13.53%; [1], unpublished) than elephant grass (9.7% protein and 36.1% fiber). There was an obstacle to EPW usage which it will potentially reduce nutrients digestibility [2], especially for sheep and even more for weaning lambs. The ability of digestive system to digest low quality forages on small ruminants was considered inadequate and showed lower capability than large ruminants [3]. Several solution explorations have been carried out to overcome this constraint for the EPW utilization. It was fermentation or silage [4,5] or created as complete feed [6], but both had not shown optimal results.
Based on constraints, this study faced how to improve the nutritional quality of edamame pod-based rations for local male weaning lambs so that it can be effectively and efficiently applied to present optimal early growing performance. This study approach was the application of mix-

exogenous enzyme additives (fibrolytic, cellulolytic or mixture) in a total mixed ration (TMR) based edamame pod waste. TMR was designed to avoid selective rejection of unpalatable portions, to ensure uniformity distribution and nutrients intake, then to optimize feed efficiency. This study aimed to evaluate the early growing performance of local male weaning lambs fed edamame pod-based rations with and without exogenous enzyme additives.

2. Methods

2.1. Experimental design

This study was carried out in the Sheep Pen of the Department of Animal Science and in the Laboratory of Feed Technology at Politeknik Negeri Jember. Nine local male weaning lambs with initial weight about 16.88±2.33 kg/head were randomly assigned into 3 levels treatment using an experimental completely randomized design (CRD). Every single level treatment was repeated 3 times. The levels treatment was 0% (control), 0.14% w/w or 1.4 g/kg, and 0.28% w/w or 2.8 g/kg of exogenous enzyme addition into edamame pod-based rations. The edamame pod-based rations contained 89.08% DM, 91.69% OM, 71.4% TDN and 12.6% protein and the exogenous enzyme added was produced by Bioproton, PTY LTD, Australia. The exogenus enzyme was a multi-fibrolytic enzyme that contained cellulase, xylanase, β-glucanase, protease, α-amilase, hemicellulase, pectinase, phytase, lipase, hemicellulase, acid phytase and acid phosphatase.

The lambs were adapted to the individual pen and kept comfortably conditions for 2 weeks. They fed edamame pod-based rations gradually by reducing the provision of forages until the feed offered reached 100% edamame pod-based rations and given drinking water ad libitum. The lambs have been maintaining for two months but the data published here for early couple weeks observation due to this study was ongoing. The parameters observed were nutrient consumption such as dry matter intake (DMI), organic matter intake (OMI), total digestible nutrient (TDN) and protein intake; liveweight gain (kg/head); and gain to feed ratio during first couple week maintenance with 2 weeks adaption period.

2.2. Statistical analysis

Data obtained were analysis using analysis of variance (ANOVA) and further tested by Duncan’s Multiple Range Test (DMRT) for the different result. It was conducted using SPSS 22.

3. Results and Discussions

The results of parameters for nutrient consumption and performances of local male weaning lambs fed edamame pod-based rations with or without exogenous enzyme addition were presented in Table 1. Nutrient consumption included dry matter, organic matter, total digestible nutrient (TDN) and protein intake were not affected (P＞0.05) by various levels of exogenous enzyme additions. They were ranged 474.5 g/d, 435.1 g/d, 380.4 g/d, and 67.1 g/d for DMI, OMI, TDNI, and CPI, respectively.

The level addition of exogenous enzyme in the edamame pod-based rations as a dry feeds has not been effective to show significant result on nutrient consumption of local male weaning lambs. It was similar with Beauchemin et al. who informed that exogenous enzymes are more effective when applied to high moisture feeds (such as silages) compared to dry feeds [7]. The direct action of exogenous enzymes before feed consumed cause the release of reducing sugars arising from partial solubilization of cell wall components [8]. Then, an increase of releasing on reducing sugars in the rumen thereby shortening the lag time needed for microbial colonization and can also enhance rapid microbial attachment and growth [9]. Additionally, exogenous enzymes increase hydrolytic activity before incubation of feed in the rumen then also help
Rumen microbes to raise microbial access into cell walls and increase the rate of fiber degradation during ruminal fermentation [10].

**Table 1.** Nutrient consumption and performances of local male weaning lambs fed edamame pod-based rations with or without exogenous enzyme addition

| Parameters          | Exogenous enzyme addition (w/w) | P-value |
|---------------------|---------------------------------|---------|
|                     | 0%                             | 0.14%   | 0.28%   |         |
| DMI (g/d)           | 406.5                          | 479.5   | 537.6   | p>0.05  |
| OMI (g/d)           | 372.7                          | 439.7   | 493.0   | p>0.05  |
| TDNI (g/d)          | 325.8                          | 384.3   | 430.9   | p>0.05  |
| CPI (g/d)           | 57.5                           | 67.8    | 76.0    | p>0.05  |
| Total gain (kg)     | 3.1                            | 4.4     | 5.6     | p>0.05  |
| Daily gain (g/d)    | 223.8                          | 316.7   | 402.4   | p>0.05  |
| Gain to feed        | 0.5                            | 0.7     | 0.8     | p>0.05  |

DMI = dry matter intake, OMI = organic matter intake, TDNI = total digestible nutrient intake, CPI = crude protein intake

ADG and gain to feed ratio were tend to enhance from 223.8 to 402.4 g/d and 0.5 to 0.8, respectively. It was equivalent to the trend of tend to increase on nutrient consumption, specifically TDN consumption. TDN determined feed energy and its consumption described the reference for amount of energy consumed that will be used to perform muscle movements and growth. The more TDN content contained and consumed, so that the more energy obtained by livestock. It dependent on the physiological status of livestock to be used as a reference in fattening programs [11]. Nevertheless, this result was similar with previous study that the enzyme addition of low or high doses to edamame waste or oat straw in lambs fed was not affected in the average daily gain [6,12], whereas it was inconsistent with the previous study which state that the addition of exogenous enzyme improved sheep performances [13]. Meale et al. (2014) reported that the application of exogenous enzyme preparations to the diets of small ruminants has little impact on nutrient intake and production [14].

4. Conclusion

According to the results, it concluded that the presence or absent of exogenous enzyme addition presented similar results on nutrient consumption, daily gain and gain to feed ratio. However, the addition of exogenous enzyme up to 0.28% w/w potentially improved the nutrient consumptions and productivity performance of local male weaning lambs. Further observations that elaborate nutrient digestibilities and ruminal fermentations need to be conducted.

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